A Strategic Partnership Promoting Water Sensitive Urban Design to the Southern Tasmanian Community

by

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Declaration

This work contains no material which has been accepted for the award of any other degree or graduate diploma in any University or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

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Abstract

The United Nation's 1992 action plan for sustainability, *Agenda 21*, focussed international attention on the need for integrated management of freshwater resources. The goal of such management is twofold: to ensure adequate supplies of water of good quality are maintained for the entire human population while preserving the regenerative capacity of ecosystems. Although this goal was not new, *Agenda 21* marked an important shift in awareness towards the need for such management in urban environments. Since this time, Water Sensitive Urban Design (WSUD) has emerged as a vital element of integrated water management in many countries, including Australia. An inter-related set of planning, design and engineering approaches, WSUD treats stormwater as a resource rather than a nuisance. In contrast to conventional conveyance approaches, WSUD maximises stormwater retention and reuse as a way of conserving water resources and reducing pollutant loads into ecological systems. The adoption of WSUD as a default urban management practice is, however, highly dependent on government authorities, industry and urban residents. Developing the capacity of these groups to understand, implement and promote WSUD is of critical importance in achieving urban sustainability. This thesis reviews several current strategies for enhancing this capacity in Australia, before providing a detailed case study of a project partnership promoting the benefits of WSUD in Southern Tasmania. Particular attention is given to barriers to the uptake of WSUD within the plumbing industry. It is concluded that the case study partnership has achieved most of its stated objectives. More creative approaches are required, however, to develop the capacity of plumbers to act as WSUD practitioners. Equally, new approaches are needed to build the capacity of local government to embed WSUD within planning frameworks.

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Preface

Twelve years ago I was living in Townsville, far north Queensland. In the two years I was there, rainfall had diminished significantly, an effect partly blamed on the El Nino weather pattern occurring at the time. In 1994 the water level in the main dam that provided the city's main water supplies had dwindled to dangerously low levels. There was heated debate about the introduction of water restrictions. The popular response was to pump water from the Burdekin River, situated a good distance to the south of Townsville.

I vividly recall my bewilderment at the time when a city as dry as Townsville had waited for crisis point before considering water restrictions. I was also bemused at the common sight of sprinklers being operated on nature strips by local councils in the middle of the day.

Having lived in Hobart for most of my life, my boyhood memories still recall water restrictions operating during the summer period. So for perhaps this reason, as an adult, the concept of adopting water restrictions and complying with them did not bother me at all, in fact I embraced the idea as the accepted norm. I cannot recall any particular environmental education being present in my formal school years that ranged from 1969 till 1980, but local council authorities had for a long time marketed water wise practices for the urban environment within Tasmania. This was an accepted way of life during the 'balmy' summer period. The same could not be said for many of the natives of Townsville. Conversations relayed a complacent attitude to the use of water and saw the Burdekin as a suitable saviour since the pipeline was already in place. While many local

people were conscious about the implications of their water use, they were not well informed about the appropriate management of water resources, and twelve years ago my knowledge of sustainable practice management of water was limited.

Much argument has been presented on the potential and actual impact of enhanced global warming on our weather and our environment in general (IPCG 2001). I believe it would be foolhardy to discredit the potential significance of global warming for water management, in particular. Many key agricultural and populous regions throughout Australia have suffered the effects of continuous drought conditions. Water supplies for our major cities are still at low capacities (National Land and Water Resources Audit, 2005) and yet we still continue to consume vast amounts of water (PCA 2005, 83). The NSW government have recently publicised (Geoghegan 2005) their intention to develop a desalination plant in Kurnell. Is this not similar to the Townsville scenario? Yes the oceans are quite plentiful in water, but could we manage our consumption of fresh water better?

Chapter 1

Introduction

1.1 The shift towards sustainability

Sustainability is not the same as sustainable development, which has become a focal point in global politics today. Davison (2001) describes sustainability as a broad social aspiration, rather than an end product. Sustainable development, then, is a pragmatic framework for political debate, policy development and management inspired and challenged by this aspiration. Put simply, sustainability is a vision, while sustainable development provides the means to attain that vision.

The concept of sustainable development first came to prominence as a result of the United Nations Conference on the Human Environment held in Stockholm in 1972. The conference placed a focus on environmental concerns and in the years following the conference, the global community acknowledged that more exploration was needed of the inter-relationships between the environment and socio-economic issues of poverty and underdevelopment (UNESCO 2006). The concept gathered pace in the 1980s in response to an increased awareness of the imbalance between economic and social progress and its effect on the environment and natural resources. Global recognition of the concept grew with the publication of *Our Common Future,* also known as the Brundtland Report, named after the chairwoman of the World Commission on Environment and Development (WCED) in 1987. The Commission defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Hay 2002,

213). This recognises that while development may be essential to satisfy human needs and improve quality of life, it should occur in such a way that the capacity of the natural environment to meet present and future needs is not compromised (UNESCO 2006). There have been many other definitions of sustainable development offered since 1987. One of the best known of these is in *Caring for the Earth: A Strategy for Sustainable Living* published by the International Union for the Conservation of Nature (IUCN), the United Nations Environment Programme (UNEP) and the World Wide Fund For Nature (WWF) in 1991: "Sustainable development is improving the quality of human life while living within the carrying capacity of supporting ecosystems" (UNESCO 2006). Together, these two definitions provide a good understanding of the crucial concept that sustainable development must benefit both people and ecosystems.

The 1992 Earth Summit held in Rio de Janerio gave high priority in its action plan for the 21st century, *Agenda 21*, to the role of education in pursuing the kind of development that would respect and nurture the natural environment. Chapter 36 of *Agenda 21* emphasised the point that education is critical for promoting sustainable development and improving the capacity of people to address environment and development issues (UNESCO 2006).

A key section of *Agenda 21* deals with the conservation and management of resources for development (DEH 2004a). Education is regarded as a key instrument to address the issues required if sustainable development of resources and the preservation of ecosystems and water are to be achieved at global, national and local levels.

In Australia, several initiatives have been implemented by the Commonwealth, State, and local governments to enact the principles of *Agenda 21*, starting with the National Strategy of Ecological Sustainable Development (NSESD) 1992. In 1990 the Australian Government established nine ESD working groups as a result of a national debate on the nature of ecological sustainable development (ESD). As briefed by Bob Hawke - the Prime Minister at that time - the role of the working groups was to "formulate strategies for sustainable development in Australia's industry sectors...to provide advice to Government on future policy directions, and to develop practical proposals for implementing them" (Diesendorf and Hamilton 1997, 286). The outcome of this initiative was the formation of the NSESD. The five key principles of the NSESD are:

- integrating economic and environmental goals in policies and activities;
- ensuring that environmental assets are properly valued;
- providing for equity within and between generations;
- dealing cautiously with risk and irreversibility;
- recognising the global dimension (DEH 2005, np).

There are strong links between *Agenda 21* and the NSESD. Each seeks to provide a framework for the development of environmentally sound and ecologically sustainable decision-making at all levels. Since the introduction of the NSESD, Australian governments have increasingly incorporated into the policies and programs the pursuit of ESD as a significant policy objective (DEH 2005 , np).

1.2 Sustainable water management

As part of discourse on sustainable development in Australia, the management of water resources within urban environments has become a very hot topic of late. Much responsibility falls on State and local water authorities to manage water use efficiently,

but the community can also play an integral role in the preservation of this invaluable life-giving resource.

Sustainable water practices and several technologies to promote them have been present in our society for several generations. The humble water tank, once present in urban properties, was gradually phased out, and even frowned upon by local authorities when better infrastructures were put in place to provide water to domestic households. Re-use of greywater for gardening purposes was a common practice used by people in Australia prior to the 1950s. Greywater systems are now available for domestic installation and are recommended primarily for toilet flushing. Leading a thrifty lifestyle was common among pre-baby boomer generations as a way of making ends meet. Thanks to modernisation and better infrastructures, later generations have become complacent in their use of natural resources due to ease of access and affordability.

The depletion of fresh water supplies in Australian society is now reaching a crisis point. Big rivers are seriously degraded, hydro-electricity supplies are being threatened by low dam levels (Hydro Tasmania, 2005) and potable water supplies are so critical that some large communities in Australia have only eight months of town water left in reserves (Marino 2005). It is evident that this scenario will not be short-lived. Aspects of Australia's future climate indicate some severe impacts on our weather systems. According to the *Climate Change Risk and Vulnerability Report* (2005), it is expected that Australia will experience higher temperatures, more droughts, severe cyclones, storm surges and rising sea levels. The Report starts from the central premise that Australia will face some degree of climate change over the next 30 to 50 years, a fact acknowledged by the Minister for the Environment and Heritage, Senator Ian Campbell

(2005). Water stresses will increase, ecosystems and biodiversity are at risk and specific areas like the Murray-Darling Basin will be hit hard. As emphasised in the Preface of this thesis, global warming is the primary cause of climatic change. The predicted impacts on our water resources are worrying, but if combined with current water management practices, the consequences could be dire.

It is imperative, therefore, that sustainable water management has to become the mainstream approach in Australia. This study seeks to contribute to meeting this need by adding to current understanding of institutional barriers to and opportunities for WSUD.

1.3 Research background

In 2005, the Master Plumbers Association of Tasmania (MPAT) received a grant from the Australian Envirofund to build a water sensitive urban design (WSUD) demonstration site at the Royal Tasmanian Botanical Gardens (RTBG). This site is located in the sustainable horticulture precinct. The project partners are: MPAT, RTBG, Hobart City Council (HCC) and the Derwent Estuary Program (DEP). The project culminated in the development of a rain garden and WSUD training module for plumbers. The realisation of this project was due to the collaborative approach that the partners took in sharing their knowledge, technical expertise and human resources. The primary objectives of the funded project are to:

- provide hands-on training for plumbers completing the WSUD GreenCity Service training module;
- create a visible educational resource for wider community;
- promote WSUD to the Hobart community;

- develop a small scale aesthetically pleasing example of a stormwater treatment/detention system to show the flexibility of such systems and their broad application;
- promote sustainable gardening;
- to fit in with RTBG's potential sustainable horticulture precinct;
- to provide a demonstration of a rain garden that may be used as a reference for designers in Hobart.

As a requirement of the Envirofund grant an evaluation has to be undertaken for the project. I was invited to carry out this evaluation. In discussion with MPAT, several questions were posed as to what would be assessed but the underlying needs were primarily the educational aspects of the project. A specific request was that an assessment should be made of the training module run by MPAT.

The WSUD demonstration site and education project addresses the general requirements of the Envirofund and several principles of *Agenda 21*. The outcomes of effective WSUD practice supports chapter 18 in *Agenda 21*, which focuses on the protection and quality of freshwater services in regards to the application of integrated approaches to the development, management and use of water resources. The general objective is to make certain that adequate supplies of water of good quality are maintained for the entire population of this planet, while preserving the hydrological, biological and chemical functions of ecosystems, adapting human activities within the capacity limits of nature and combating vectors of water-related diseases. Innovative technologies as supported by WSUD are needed to fully utilise limited water resources and to safeguard those resources against pollution.

The objectives set out by the project partners and in particular the training module run by MPAT also support Chapter 36 of *Agenda 21* in recognising that education is an essential tool in achieving sustainable use of our natural resources.

Therefore, the aims of this thesis are to investigate what strategies are present and successful in providing Southern Tasmanian institutions and industry a pathway to develop sustainable practices within their profession. *Agenda 21* identifies education and partnerships as key instruments in providing the means for sustainable outcomes to be achieved. A specific focus will be on life-long learning strategies being utilised by MPAT in developing the capacity for plumbers to understand and apply WSUD principles within their work practice. In addition to this, an assessment will be done on the effectiveness of the project overall, in promoting WSUD to the Southern Tasmanian Community.

1.4 Research methodology

The term "evaluation" or "evaluation research" as defined by Rossi and Freeman (1993, 5) is "the systematic application of social research procedures for assessing the conceptualisation, design, implementation, and utility of social intervention programs". This recognises that social research methodologies are widely used to judge and improve the operation of programs and policies that serve human beings from the earliest stages of program conceptualisation and design through to its development and implementation (Rossi and Freeman 1993, 5).

Because this evaluation was to focus on attitudinal and behavioural aspects of barriers to and opportunities for the uptake of WSUD, it was decided a qualitative approach

would best aid in the evaluation required. In a broad sense "qualitative research is concerned with elucidating human environments and human experiences within a a variety of conceptual frameworks" (Winchester 2005, 4).

The choice of criteria to use to measure the success of this project was governed by internal and external influences. MPAT requested to have their training module assessed, while the researcher was keen to look at the institutional architecture of the project partnership, with a particular reference to its success in promoting the concept and practice of WSUD within Southern Tasmania.

The approach taken in this study is best classified as participatory action research (PAR). Thomas-Slayter (1995 cited in Kindon 2005, 207) regards participatory action research as an approach that "involves academic researchers in research, education, and socio-political action with members of community groups as co-researchers and decision-makers in their own right." In PAR, the need for research into a particular question or problem often involves some form of preliminary consultation between the researcher and research participants (Kindon 2005, 208). Such collaborative problem definition increases the likelihood of research participants being willing and able to act on any research findings. The quality of findings provided through PAR is, in part, dependent on the quality of relationships the researcher is able to establish with research participants. The creation of open and frank dialogue, mutual respect and joint commitment in creating and maintaining a shared sense of purpose is crucial. While different approaches to PAR are possible (Kindon 2005), the one developed here can be described as consultative participation and involves both collaborative definition but

also independent selection of research methods and analysis of findings by the researcher.

The research participants involved in this study were selected using both criterion sampling and opportunistic sampling. Criterion sampling involves the selection of cases that meet a particular criterion while opportunistic sampling requires some flexibility from the researcher in that he or she will follow new leads that may arise during the study (Bradshaw and Stratford 2005, 72).

In this study four primary informants were selected due to their direct involvement in the WSUD project. Questionnaire participants were selected due to their participation within the training module or due to their membership of MPAT. Opportunities to attain information from other secondary informants did occur as a result of information supplied by key informants and through background research carried out by the researcher. Figure 1.1 illustrates the methodological framework used in this study.

1.5 Research methods

Through the use of a range of interpretive and material practices qualitative research makes the world visible through a series of representations, including field notes, interviews, conversations, photographs, recordings and memos (Denzin & Lincoln 2000, 29). Qualitative research in geography is used to address a wide range of issues, events, and places and, as indicated by Denzin and Lincoln, involve the application of a variety of methods.

1.5.1 Interviews

Oral interviews were one of the qualitative research methods used in this study. It was used in two formats, one as a semi-structured interview with key informants and the other in the form of personal communications with informants in telephone conservations. "Interviews are an excellent method of gaining access to information about events, opinions and experiences" (Dunn 2005, 80). The interview process used in this study provided an insight into differing opinions or debates within the project group, but also revealed a consensus on many issues. The semi-structured interviews were organised around an interview schedule (see Appendix 3) that assisted the interviewer in generating conversation on the particular issues being studied. Responses from the key informants were written down, and later typed up for coding and analysis. Prior to the interviews taking place, an initial telephone call was made to each key informant asking them if they would be interested in participating in an interview. Letters of introduction were then emailed to them outlining the research topic and including a request for their participation (see Appendix 1). Attached to this was an information sheet outlining the research topic, the conditions of the interview and the approval of the University's Human Research Ethics Committee (see Appendix 2). A copy of a consent form was also included and a duplicate copy was presented to participants, prior to the interview.

Follow up conversations were carried out with informants to clarify any specific matters indicated by analysis of transcripts and to attain further information. On the basis of information provided by key informants, other informants were contacted within the project institutions as well as with agencies in other Australian states. Personal correspondence was also undertaken with other agency representatives in mainland

states. A set of structured questions relevant to a specific research was used to attain information from targeted informants (see Appendix 3).

1.5.2 Survey

A key task in this study was to evaluate the effectiveness of the MPAT WSUD training module in facilitating the uptake of WSUD within the plumbing industry. This was a direct link to the specific research question: What strategies are successful in facilitating WSUD practices within the plumbing industry?

Questionnaires were used to help gather data to carry out this evaluation. McLafferty (2003 cited in McGuirk & O'Neill 2005, 147) points out that "questionnaires are useful for gathering data about people, their behaviour and social interactions, attitudes, and opinions, and awareness of events." Questionnaires were also considered to be a relatively rapid, time and cost effective way of eliciting responses from a large sample of participants. Two different questionnaires using predominately open questions were sent to two groups of plumbers. "Open questions have the potential to yield in-depth responses in keeping with the thrust of qualitative research: to understand how meaning is attached to process" (McGuirk & O"Neill 2005, 149). One questionnaire was designed for nine plumbers who had completed the WSUD training module (see Appendix 6). The other questionnaire was sent to forty plumbers who had not participated in the module, but were members of MPAT (see Appendix 7). The questionnaire sent to these non-participants was tailored to assess the extent of knowledge they had of WSUD and their reasons for not participating. The questionnaire sent to the WSUD module participants was tailored to assess the benefits and relevance they had received from the training, and their understanding of WSUD.

The questionnaires were sent to the plumbers by MPAT. A letter of introduction and an information sheet was also sent to them in a similar format as those sent to the Key Informants (see Appendices 4 & 5). Two separate pre-paid envelops were enclosed, one clearly marked for the anonymous questionnaire and the other clearly marked for the discussion group reply to allow anonymity to be retained.

1.5.3 Evaluation process

A systematic inductive approach has been used in building ideas and themes from data collected for this study. This fits within "grounded theory" where the purpose is to generate theories from empirical data (Cope 2005, 224). The information gathered from empirical data and background literature revealed three central themes that represent integral components of the concept of sustainability: education, partnerships and sustainable practice. These themes have influenced the criteria design used for the evaluation of the WSUD project. The existing objectives written by the project partnership were categorised according to these themes and absorbed within the assessment criteria. Thus, the success of the project has been measured on its ability to:

(1) promote the growth of collaborative partnerships;

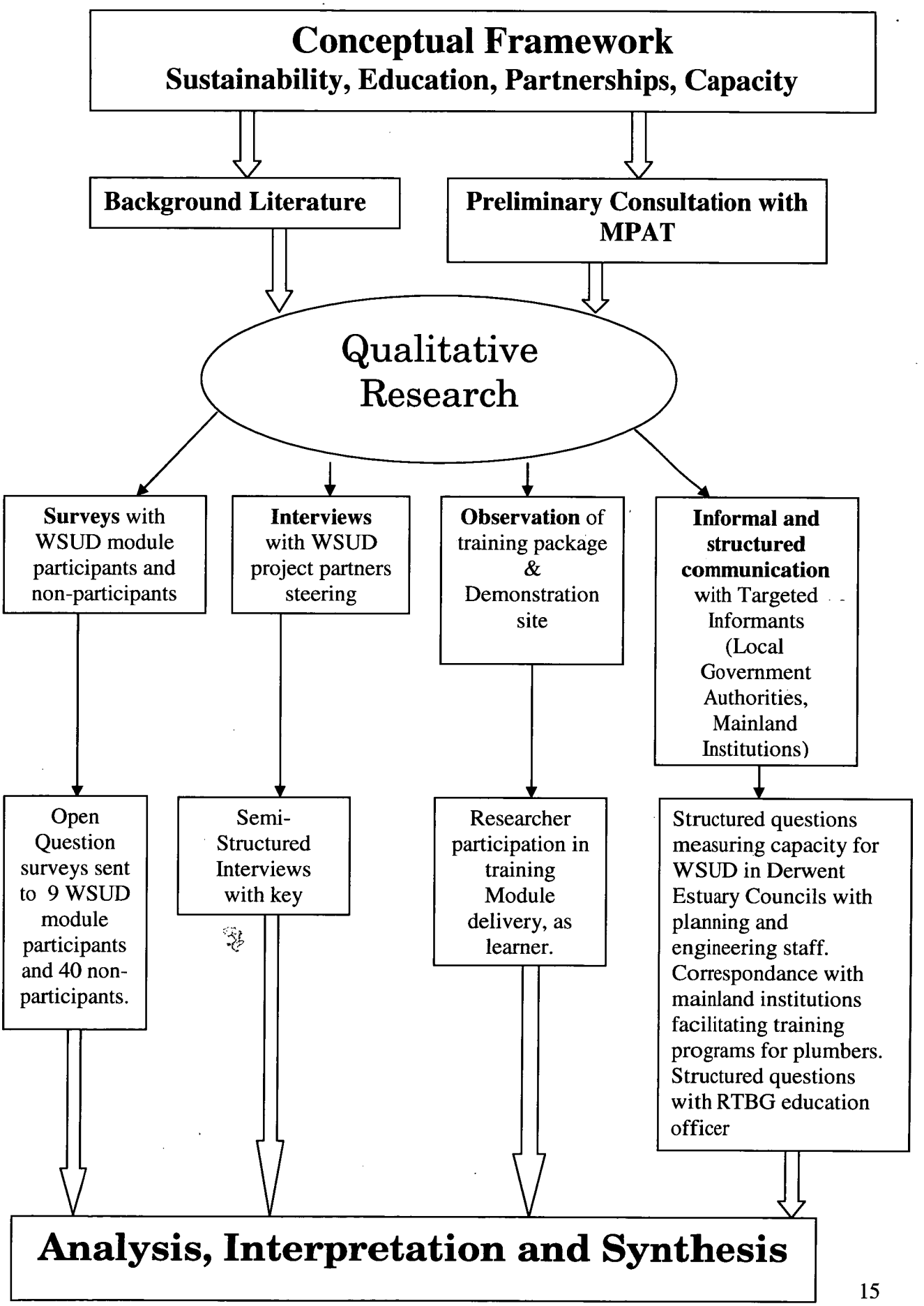
(2) implement practices promoting sustainability;

(3) development education programs to deliver capacity for achieving sustainability;

(4) develop awareness of sustainable practices.

Further information on the evaluation process is provided in Chapter 5.

Figure 1.1 Methodological Framework



1.6 Content overview

The main focus of this study is on an institutional project partnership that promotes water sensitive urban design as an effective strategy to help manage water in a sustainable manner. Chapter 1 will provide an explanation of this project. The significance of sustainable water management will be discussed, and the methodology used in this research.

Chapter 2 will focus on the important roles that partnerships and education have in facilitating the adoption of sustainable practices in societies. Following this, Chapter 3 focuses on an innovative strategy to assist in the sustainable management of water - water sensitive urban design. An explanation of the origins of water sensitive urban design within Australia and its application and objectives will be discussed. Chapter 4 will investigate and discuss present barriers to the uptake of WSUD as the default stormwater management practice within Australia, and appraise some strategies being used to overcome these barriers. Chapter 5 will focus on the origins of the project partnership at the core of this study. This will also include results of an evaluation undertaken for the project and a discussion of these results. Finally, Chapter 6 presents and discusses the findings of this research. It concludes with recommendations for further study relevant to this research.

Chapter 2

Strategies to attain sustainability: partnerships and education

2.1 Introduction

The main aim of this study is to evaluate the success of a project partnership promoting WSUD to industry and the general community. WSUD is considered to be one mechanism that can assist society in the practical implementation of sustainable forms of development. The formation of partnerships such as these is seen be an effective strategy in fostering sustainable behaviour throughout industry and the general community (Tilbury 2004, 103). Education is one of the key instruments used by partnerships to facilitate greater understanding of sustainability and to encourage active participation in the planning and implementation of sustainable practices. Tilbury (2004) points out that the formation of *Agenda 21* has seen education and capacity building recognised as essential elements to help shift societies towards sustainable paths of development. She emphasises the vital importance these processes play in enhancing people's abilities to find alternatives to unsustainable practices. The structure of a partnership has a critical impact on its effectiveness in educating and building the capacity amongst individuals, communities, industry and institutions to adopt a sustainable lifestyle.

This chapter sets out to achieve two things: one, to discuss and analyse an appropriate partnership structure that would provide effective means to attaining sustainability; and two, observe educational initiatives and strategies that facilitate an attitudinal shift towards sustainable behaviour.

2.2 A global partnership

Agenda 21 was developed by a majority of national governments through the United Nations and ratified at the 1992 UN Earth Summit. It is a global action plan for attaining sustainability (Jaskolski 2001, 24). It regards social partnerships as vital to the achievement of sustainable development. It recognises that government and international agencies alone cannot achieve sustainable development. The community must also become involved. Community partnerships and industry organisations must become a key player in the development of policy and the implementation processes that will enable it to become a reality (DEH 2004a). Streck (2002 cited in Ivanova 2002, 12) sees partnerships as dynamic structures that can provide an alternative means to finding solutions where traditional approaches have not.

Agenda 21 emphasises that sustainable development will only happen if it is explicitly planned. The 2002 World Summit in Sustainable Development (WSSD) broadened the vision of WCED and created a plan to expedite the realisation of the goals outlined in *Agenda 21*. The WSSD emphasised that partnerships at global, regional, national and local levels are keys to achieving these goals. The Bali Guiding Principles provided an informal consensus of the desired structure of partnerships that would fit the parameters for the WSSD process (Hermati and Whitfield 2003). A key criterion of these principles indicated a preference for a multi-stakeholder approach. Table 2.1 illustrates that

stakeholder partnerships can exist in different forms; this is often dependent on the nature of the problem being addressed. Not every problem needs to be addressed in the same manner. It is often appropriate for a specific problem to be overcome by specialists within the relevant field, however, some problems are often more complex, and require a range of participants to overcome it. These participants may have a direct interest or stake in the outcome, or play an advisory role.

Table 2.1 Traits of stakeholder partnerships and other related forms of participatory policymaking

	Issues	Participants	Stages of the Policy Cycle
Stakeholder Partnership	Multiple issues united by a common theme, addressed sequentially or simultaneously.	Interest groups, citizens, and multiple federal, state, and local agencies. Meetings typically open to the public.	Full cycle (problem definition, planning/decisionmaking, implementation, assessment). Indefinite duration.
Advisory Committee	A specific project or program conducted by a public agency or private enterprise.	Interest groups, technical experts, and/or public agencies. Selected by the sponsor.	May address any or all stages, over an extended period of time, depending on the scope of the sponsor's project or program.
Public Hearing	A specific project proposed by an agency or private developer.	The project proponent, interest groups, citizens, and one or more permit-issuing agencies. Meetings open to the public.	Planning stage only. Timing is often driven by statutory deadlines. Disbands after the plan is finalized.
Negotiated Rule Making	A specific proposed regulation.	Affected interest groups. Selected by the one, rule-making agency.	Rule-making stage only. Disbands after the rule is finalized.

(Source: Leach et al. 2001, 3)

2.3 The collaborative partnership

The role of partnerships in developing sustainable practices has grown in significance over the last 20 years. Long and Arnold (1995 cited in Hartman et al. 1999, 255) define partnerships as "voluntary collaborations between two or more organisations with a jointly-defined agenda focused on a discrete, attainable and potentially measurable goal". Collaboration is central to the partnership theme. Gray (1989 cited in Hartman et al. 1999, 256) defines collaboration as "a process through which parties who see different aspects of a problem can constructively explore their differences and search for solutions that go beyond their own limited vision of what is possible." Understanding of collaborative partnerships has derived from decades of field-based and theoretical efforts by individuals concerned with social equity, sustainable use of natural resource and community-based and community-run initiatives (Borrini-Feyerabend et al. 2000, 1).

A collaborative partnership may be integrated in all aspects of the policy cycle, including: planning, implementation and evaluation. Key to such collaborative policy-making is a commitment to participatory decision making. In the planning spectrum, collaborative planning can be regarded as an umbrella term to describe an eclectic mixture of planning theories that provide the structure of a particular planning process. An emphasis is placed on the participatory approach in the decision making process.

One of the key components of the collaborative planning process is communication. Habermas (1984 cited in Healy 1996, 239) is one of the better known theorists to argue that society is not made up of egocentric individuals pursuing their own interests, but that individual identities and interests are constituted through relation to others. Our

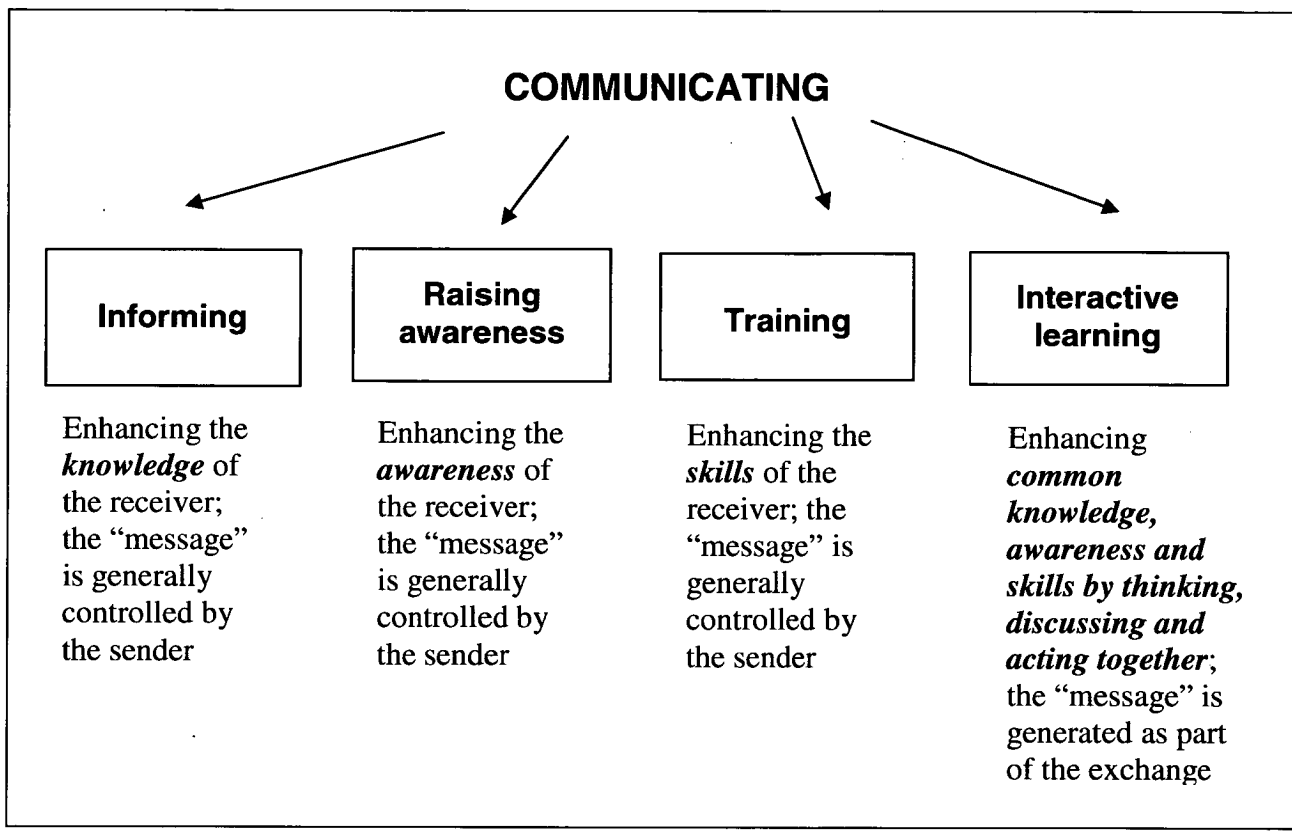
ideas about ourselves, interests and values are socially constructed through our communication with others and the collaborative work this involves (Healy 1996, 239).

Within collaborative planning processes the communicative process is potentially one of the weakest links. Participants within this process are diverse in their level of education, culture, gender, race, age, political persuasion and personal values. These factors may give rise to misconception, mistrust and impatience with the collaborative process. It is of utmost importance that all parties involved are given the opportunity to develop a greater understanding of the issues at stake. Chiovoloni (1996 cited in Borrini-Feyerabend et al. 2000, 12) provides a simple, but innovative model that could be used to attain successful outcomes during the communicative process (see Figure 2.1). It distinguishes various types of objectives for a communication initiative. These may include: 'informing', 'raising awareness' and 'training' which can operate in an interactive fashion, but more frequently are carried out in a 'top-down' mode, with the 'sender' totally in control of the 'message' to be passed on, and the 'receiver(s)' hardly able to influence it. A rather different communication situation is generated by 'interactive learning'.

Interactive learning is crucial for co-management initiatives, as these seek to overcome the logic of top-down expert authority and prescribed behaviour. Co-management is a shared responsibility taken by concerned stakeholders with all having a varying degree of decision-making power. Whenever there is a gap or a conflict of interests in a desired action, efforts at merely transferring information, awareness or skills may not be sufficient. Only interactive learning, built on the direct confrontation and dialogue

among different views (thinking, discussing and acting together) can overcome the gap or help in managing the conflict (Borrini-Feyerabend et al. 2000, 12).

Figure 2.1 Communication techniques



(Source: Borrini-Feyerabend et al. 2000, 12)

The structure of collaborative planning can lead to failure of the process due to: unfamiliarity with the process, lack of process skills, and managing tension through the process and the world around it (Wondolleck & Yaffee 2000, 63). In the case of the first point, 'unfamiliarity with the process,' all participants can be subject to this. Agency staff must have the appropriate training as facilitators and organisers to help promote the process. Lack of training could see much confusion and loss of valuable time. All participants must be informed of the process early in the piece to provide a clear

understanding of its operation. This links directly to the next point – 'lack of process skills'. Traditionally, departmental planners are accustomed to working decisively and presenting complete plans with little or no consultation from people outside of their agency. They need to learn new skills to empower people in the role as a mediator, catalyst or broker. They need to develop the patience that consensus building requires, and to present concepts for discussion before any decisions are made. The third point, 'managing tension through the process and the world around it', involves external influences outside the collaborative process. One example is that of members of a collaborative working group who, despite their desire to work collaboratively and create a visionary outcome, were constrained by political orientations and the viewpoints of their associations. As leaders of their groups, they presented their group's point of view, and were reluctant, in this public forum, to challenge or change these (Wondolleck & Yaffee 2000, 65).

2.4 Opportunities and risks relating to collaborative partnerships

The promotion of collaborative partnerships for sustainable development has both been welcomed and criticised. Heath & Wall (1992 cited in Hall 1999, 279) believe that an integrated or shared approach to planning is neither 'top-down' "where goals at each level in the organisation (or spatial area) are determined, based on the goals at the next higher level" nor 'bottom-up', where the goals of individual units are aggregated together. Instead, integrated planning may be regarded as a 'collaborative' approach that requires participation and interaction between the various levels of an organisation or unit of governance and between the responsible organisation and the stake-holders in the planning process to realise both horizontal and vertical partnerships.

Hall (1999), Hartman et al. (1999), Ryan & Brown (2000) and Hermati & Whitfield (2003) have all provided an insight to the issues that portray collaborative partnerships as a positive or negative attribute to attaining sustainable development. These have been summarised below:

2.4.1 Risks

- Governmental responsibility, corporate influence and inequity

  The partnership approach emphasises the participation of NGOs. Some have perceived that this may lead to governments decreasing their input and responsibility in realising sustainable development. It also gives rise to concerns in regards to the amount of power a corporation may hold over smaller independent stakeholders in the decision making process. There are also significant differences in resources available to partners or potential partners. Those without adequate resources will inevitably find it difficult to initiate partnerships that reflect their needs and concerns. This can lead to a biased representation of what actions are most necessary within the whole group of partnerships.

- Wasting resources

  It has been questioned on how effective partnerships are in delivering change in an efficient manner. Stakeholder partnerships, as illustrated in table 2.1, can consist of a high number of participants, which have a diversity of interests and concerns. Situations such as these often stall the decision-making process due to a lack of consensus on a proposed solution. A good deal of time and money may be utilised for small gains, particularly in the early formation of the partnership.

The involvement of several stakeholders will not always be the most appropriate way to implement the desired plan.

- Top-down and bottom-up

The interaction of government and non-government stakeholders in a partnership can create conflict in regards to leadership. It is important to strengthen the leadership of governments through support of the process but every effort should be made to encourage people to make their own, unique contribution, based on their analysis of their situation, their priorities and their assessment of their own capabilities. This is supported by the NSW government in their documentation on government/community agreements on water management, which states:

> The Government is now not only responsible for providing direction - it also facilitates opportunities for the community to participate in establishing agendas and developing acceptable outcomes. This represents a reciprocal agreement between the community and government where each brings different experience, expertise and knowledge to the task of water management (DLWC 1998).

2.4.2 Opportunities

- Qualities and effectiveness

Collaborative partnerships can progress from 'under-organised systems' of independent or adversarial stakeholders to more tightly organised stakeholder relationships, characterised by coordinated decision-making (Hartmen et al. 1999, 257). The collaborative process moves aside existing social structures, bringing together opposing values, exercising flexibility and changing traditional

independent and competitive mindsets. They bring together a wide range of knowledge, perspectives and capabilities. A creative approach to a problem is enabled due to the interaction of a diverse range of people (Hermati & Whitfield 2003, 4).

- Learning

  Due to its complex nature, the implementation of sustainable development is a difficult undertaking. Contributions from all stakeholders are required. Through their involvement in the process, people learn from documents, from individual experiences, from interaction with others and from working with others. Partnerships, be they successful or not, provide an interactive learning environment. As such, they provide learning opportunities for all involved (Hermati & Whitfield 2003, 4).

- Good governance and the development of democracy

  The mechanism of collaborative partnerships provides opportunities for participation from all levels of the community. Their potential for empowerment can attract all stakeholders and all citizens involved. Because such participation is active and creative, it can harness human and other resources that are simply not accessible otherwise (Hermati & Whitfield 2003, 4).

- Culture change

  The notion of good governance relates to the opportunities for cultural change that are inherent in the partnership approach. A culture of consultation without brushing over differences, consensus-building without coercion, transparency, accountability, stakeholder responsibility, attention to people (rather than documents and institutions), respect for differences, and unity in diversity needs to be adopted (Hermati & Whitfield 2003, 4). If partnerships are successful in the joint delivery of a practical task, they can be considered as an ideal mechanism for overcoming prejudice and stereotypical perception and behaviour. A transparent relationship sets the precedent for successful delivery of sustainable development practices.

Collaboration can be difficult and requires much effort from all involved, but obstacles can be overcome. By following guideposts established by innovators, individuals, agencies and groups, success can be attained in ways that are empowering, stimulating and productive for all (Wondolleck & Yaffee 2000, 48). Two primary factors that will influence the nature of a collaborative partnership is whether or not participants will hold a 'shared vision' concerning the nature of the problem, and their tolerance for compromise and a willingness to 'agree to disagree' (Hartman et al.1999, 257).

2.5 Education for sustainable development

In 2002, the United Nations' Johannesburg WSSD proclaimed 2005-2014 'the Decade of Education for Sustainable Development' (DESD).The United Nations vision of education for sustainable development is summarised below.

Education for sustainable development is about learning to:

- respect, value and preserve the achievements of the past;
- appreciate the wonders and the peoples of the Earth;
- live in a world where all people have sufficient food for a healthy and productive life;
- assess, care for and restore the state of our Planet;
- create and enjoy a better, safer, more just world;
- be caring citizens who exercise their rights and responsibilities locally, nationally and globally. (UNESCO 2005)

In Australia, environmental education has been a recognised sub-discipline of education since the 1970s. Recently, however, emphasis has grown on not simply educating people about environmental problems, but also about how to empower them to bring about positive environmental change. In the year 2000, the Australian Government released the *Environmental Education for a Sustainable Future: National Action Plan.* This action plan sets out to address the needs of environmental education in Australia. It was also intended to be a starting point for enhanced national effort in support of Australia's ecologically sustainable development (Environment Australia 2000). The plan recognised that many sectors of Australian society are involved in environmental education activities. This document was designed to provide leadership to these sectors and promote better coordination of these activities. Education 'for' sustainable development is a key focus in this Plan. Learning how to motivate and manage change towards sustainability within organisations or institutions is of vital importance to this educational approach (Tilbury 2004, 103). Fien (1993), Sterling (2001) and Tilbury (1995) emphasised that education 'for' sustainable development differs from traditional environmental education approaches in that it goes beyond addressing the values and attitudes of the individual to build their capacity for instigating and managing change (Tilbury 2004, 103). The National Action Plan emphasises the relationship between

education 'for' sustainable development and education 'about' sustainable development. Tilbury (2004) points out that the later focuses on knowledge of sustainable development, including the issues relating to human actions considered unsustainable such as climate change, non-renewable resource use and loss of biodiversity. The combination of these two approaches to learning for sustainability will provide people with knowledge and understanding to engage with sustainable development issues, plus the ability and capacity to plan and implement change towards sustainability within an organisation, community or industry (Tilbury 2004, 104).

The WSSD recognised that learning 'for' sustainability was not confined to the formal classroom environment but is a lifelong engagement (UNESCO 2005). It can be formal and informal and can occur in a diverse range of environments. A national review of environmental education and its contribution to sustainability in Australia recognises the significant role that the community, industry and educational institutions play in providing environmental education. Traditionally, the formal education sector is the dominant provider of environmental education in Australia, but it has not always been a great supporter of education 'for' sustainable development (Tilbury 2004, 105). Environmental education is not a core subject within Australian schools, with the exception of NSW. It is often integrated across the curriculum framework in other core subjects but remains marginalised in practice. Key learning areas such as 'Science' and 'Studies of Society and the Environment' do provide students with exposure to environmental studies, but opportunities for learning or developing an understanding of sustainability in schools is limited (Tilbury 2004, 106). These issues and others, as observed in the review have been addressed in a substantial manner. The underlying message of the recommendations is the need for education 'for' and 'about' sustainable

development to be made a core part of the curriculum in all educational institutions from early childhood through to senior secondary.

Non-formal community education is seen to be a key component of lifelong learning and learning for sustainability (Tilbury 2004, 107). It provides the opportunity for members of the community to become informed and empowered to play an active role in attaining sustainability in local areas (Tilbury et al. 2005a, 1). Within Australia, community education has evolved over time from programs promoting awareness with a focus on information sharing to participatory programs with a focus on action and lifelong learning, all aiming to build healthy and sustainable communities (Tilbury 2004, 107). 'Community capacity building' and 'learning for sustainability' are relatively new approaches to education 'for' sustainable development but are increasing in use. Community capacity building looks to develop skills and the capacity for participants to become actively engaged in community decision-making and policy development. Learning 'for' sustainability focuses on reflective thinking and encourages them to be adaptive when there is a need for change (Tilbury et al. 2005a, 2).

Research carried out by the Australian Research Institute in Education for Sustainability (ARIES), revealed that industry and business is still lacking in capacity to engage or respond to issues of sustainability. A number of companies do provide training for employees with a focus on environmental management and occupational health and safety; however, few go further to evaluate the impact of that training and the contribution that it makes to industry sustainability (Tilbury 2004, 109). Companies struggle to distinguish between environmental performance and the broader notion of

sustainability. The realisation of sustainable practice within corporate business and industry is dependent on their willingness to transform in a holistic manner that includes their core thinking, policies and practices (Tilbury et al. 2005b, 3). Evidence provided by some case studies suggests that organisations can accelerate the change to sustainability using the principles of adaptive management. This approach is defined as organisational learning (Tilbury et al. 2005b, 3). The key element is the promotion of information exchange between employees, creating a workforce that is more adaptive and acceptable of change and willing to develop initiatives to achieve the change for sustainability. This systems approach employs certain principles of learning for sustainability, such as "envisioning, systems and 'critical' thinking to create an atmosphere of team learning and develop shared visions and systems thinking" (Tilbury et al. 2005b, 3).

2.6 Conclusion

The realisation of sustainable communities will be highly dependent on innovation. "Innovation is best achieved in a culture that embraces learning" (Tilbury et al. 2005b, 4). This chapter has illustrated that learning 'for' sustainability needs to become a lifelong endeavour for all members of the community. Innovative ideas are required for societies to make the transformation towards sustainability. It is recognised that institutional and community partnerships must play a lead role in facilitating this paradigm shift. They potentially offer the ideal environment for learning 'for' sustainability and provide the mechanisms for change to occur.

Chapter 3

What is water sensitive urban design?

In 1992, the Commonwealth, State and Territory Governments introduced the National Water Quality Management Strategy (NWQMS). This strategy supports the principles of the NSESD. The NWQMS recognises that if quality objectives are defined and either maintained or achieved within a particular waterway, then a significant contribution will have been made toward attaining sustainable urban development goals through the protection of the environmental values of these waterways (Mouritz et al. 2006).

In 1994 the NWQMS was included in the Council of Australian Government's (COAG) Water Reform Framework. The framework allows all stakeholders to make a contribution to the development of water quality management throughout Australia and New Zealand and provides guidelines for the management of the key elements of the water cycle. One of these guidelines focuses on urban stormwater systems and adopts the perspective that stormwater is a resource rather than a nuisance. Over the past twelve years, water sensitive urban design (WSUD) has emerged as the leading approach to replace the conveyance method of stormwater management with retention and reuse, both to use as a secondary water resource and to help reduce pollutant loads onto ecological systems from urban water runoff. This makes WSUD of key relevance to the concept of ecologically sustainable development as does the realisation and promotion of systems based approaches to the management of the environmental values and associated water quality of urban waterways (Mouritz et al. 2006, 2).

The scope of WSUD in its applications has grown since its inception in 1994 (Wong and Eadie 2000), but the practice and the technologies associated are still regarded as an alternative, rather than the default approach to stormwater management. WSUD is a sustainable water management practice that can help transform Australian communities into sustainable communities.

This chapter will discuss the need for WSUD development within Australia, its design components and its outcomes. A particular emphasis will be placed on the benefits of this practice with particular reference to environmental concerns and water conservation objectives. A key barrier to the adoption of WSUD is the perception that it is not cost-effective. This issue will also be discussed.

3.1 The need for water sensitive urban design

3.1.1 Climatic change and rainfall

Climate change represents a significant threat to our water resources. Pittock (2005) predicts rainfall patterns will change quite dramatically in the medium term. Rainfall will decrease in the winter-spring period over the southern half of the continent while potential evaporation will increase across Australia. Pittock (2005) believes that changes in the climate will lead to increased drought, greater fire danger and more soil erosion, as well as more floods and more intense tropical cyclones in some areas. Apart from the impact on our ecosystems, Pittock (2005) predicts that likely changes over coming decades will have negative impacts on Australia's water resources, with less runoff leading to irrigation shortfalls and more competition for water, increased salinity and more algal bloom. Further analysis suggests that increased rainfall will occur predominately in areas where human population is relatively low, such as northern

Australia and Tasmania. In southern mainland Australia competition for water resources is already high for both human and natural use and the likely event of diminished winter rainfall will see reductions in water supply appear as a probable event. Interestingly, Tasmania shows a different pattern to the rest of the country with decreased rainfall in the summer and increases in the winter with the likelihood of a higher annual water supply (Pittock 2005).

3.1.2 The Tasmanian scenario

The mean annual runoff of water in Tasmania is 44,842,112 ML. Approximately 12 % of Australia's runoff originates from Tasmania, although it represents only 1% of the total land area of the continent (National Land and Water Resources Audit 2006, n.p). Based on this figure it would appear that Tasmania has a much higher level per capita of water resources. Water in Tasmania is allocated for domestic, industrial, agricultural and for hydro-electricity. Hydro Tasmania is the State's largest water user (National Land and Water Resources Audit 2001, np). Recent dry spells in 2004/2005 have seen water storage areas for hydroelectricity severely reduced (see Table 3.1), causing some concern about the future security of hydro-electricity generation.

The State's urban areas are susceptible to regular dry summer periods when water demand can be greater than natural streamflows. Under these situations water extraction from rivers and streams is restricted to protect environmental needs and those of stock and irrigation users (National Land and Water Resources Audit 2006, np). There is also a large variation in runoff throughout Tasmania. The average annual rainfall in the midlands is approximately one sixth of the rainfall on the west coast and runoff varies from 80-90% in the Pieman River area to only 10-15% in the Coal River (National Land

and Water Resources Audit 2006, np). Due to this imbalance of rainfall distribution across the state, catchment areas servicing major population centres and irrigation schemes are subject to more acute pressures, particularly in dry seasons.

Table 3.1 Water storage capacities in Hydro Tasmania storage facilities 2004-2005

WATER STORAGES

STORAGE	PER CENT FULL	
	1/7/2005	1/7/2004
Lake Augusta	32	98
Great Lake	16	24
Arthurs Lake	54	68
Lake St Clair	21	65
Lake King William	36	82
Lake Echo	20	60
Tungatinah	34	86
Lake Mackenzie	44	100
Lake Rowallan	8	100
Lake Pedder	5	61
Lake Gordon	27	32
Lake Murchison	1	100
Lake Mackintosh	2	100
Lake Burbury	10	79
TOTAL	**22.7**	**38.2**

(Source: Hydro Tasmania 2005, np)

Between 1983/84 and 1996/97, Tasmania saw an increase of 173% in mean annual surface water use (National Land and Water Resources Audit 2001, 61). Much of this increase could be attributed to new irrigation systems, small hydro schemes and fish farms being developed throughout the State. Expansion for new consumptive purposes now has to rely largely on storing plentiful winter streamflows for later use during summer or use of groundwater. To store surfacewater, there are a number of private proposals in the State seeking approval for large storage construction (National Land and Water Resources Audit 2006, np).

The River Derwent, the major tributary supplying sixty percent of Hobart's water supply (PCA 2002, 25), has a sustainable yield of 812 000 ML of which 777 346 ML are allocated for irrigation, consumption and hydroelectricity (National Land and Water Resources Audit 2001, np). This places it in Category 3, as classed by the National Land and Water Resources Audit (2001), as being close to, or at its maximum extraction limit. The category of this waterway requires:

> a high level of management inputs. Resource information and monitoring are vital for these systems. Development trends depend on installation of appropriate water markets to move water to a higher value use and to provide surplus for development or the environment through efficiency gains (National Land and Water Resources Audit 2001, 15).

Despite its relatively large volume of accessible water, drier and warmer summers may see some reduction in the streamflow of the Derwent River. This is at a time when both demand for irrigation and urban consumption is at its annual peak. Hydro Tasmania also draws water from Lake St Clair, which is the main catchment area for the headwaters of the Derwent River. In the dry spell of 2004-2005, Lake St Clair dropped in capacity from 65% to 21% (see Table 3.1).

The Derwent estuary receives stormwater by way of 13 major rivulets and over 270 large outlet pipes (DEP 2004a, 1). Data provided by DEP (2004a) has shown that faecal bacteria found in stormwater outlets frequently exceeds recommended guidelines for recreational purposes and stormwater runoff is responsible for delivering an estimated 45% of urban sediment load into the estuary. In addition, testing has found oils and

heavy metals to be accumulating in sediments near some stormwater outlets (DEP 2004a, 1). In incidences of high rainfall, several city beaches are closed to recreational users and some locations are permanently not recommended for swimming or fishing. Despite the loss of important habitat and poor sediment quality, the River Derwent remains an important and productive ecosystem that sustains a diversity of marine and aquatic fauna (DEP 2004a, 1).

Hydro Tasmania and agriculture are the main consumers of water in Tasmania. Due to this fact it is arguable that the practice of WSUD in the Tasmanian context within urban environments may not have a substantial impact on water reserves alone. However, the combination of WSUD, greywater and blackwater recycling and more efficient irrigation practices, would reduce the stress on freshwater reserves. Through the retention of stormwater as a resource and other waste waters local water authorities would be able to apply a more flexible approach to water management during times of high water demand. Also of significance would be the reduction of pollutants impacting on natural habitat through the use of WSUD.

3.1.3 Environmental problems associated with stormwater runoff

3.1.3.1 Nature of storm water contaminants

Traditionally, stormwater runoff from urban areas has been considered to be relatively clean from a water quality perspective, with minimal impact on receiving streams, groundwater aquifers and oceans. It was not until the latter part of the last century that a better understanding has been gained about the quality of urban runoff, its relationship to quantity and the associated adverse effects on receiving waters (OECD 1986). Historically, industry and poor sewerage infrastructure were seen to be the major

contributors to the pollution of urban waterways. It is now recognised, however, that stormwater runoff rivals or exceeds discharges from factories and sewage plants as a source of pollution (NRDC 2006).

The Commonwealth Environment Protection Agency (CEPA 1993) describes in great detail the contaminants often found in stormwater runoff from roadways, footpaths, paved areas, car parks and roofs. The contaminants in stormwater vary according to the water quality, but often include some or all of the following eight types:

1. Suspended solids

Suspended solids can be organic-derived primarily from sewage, or inorganic-derived from surface runoff. Suspended solids reduce light penetration in water, affecting the growth of aquatic plants. When silts and clays settle, they may smother bottom dwelling organisms and disrupt their habitats. Since metals, phosphorous and various organics are absorbed and transported with these particles, sediment deposits may lead to a slow release of toxins and nutrients.

2. Nutrients

Nutrients which promote the rapid growth of aquatic plants, including non-toxic and toxic algae, come from sewage overflows, industrial discharges, animal wastes, fertilisers, domestic detergents and septic tank seepage.

3. Oxygen-demanding materials

Sources of oxygen-demanding materials are biodegradable organic debris, such as decomposing food and garden wastes and the organic material contained in sewage.

The biological and chemical oxygen demand of sewage (BOD and COD) is high. Aquatic fauna cannot survive if oxygen levels are too low.

4. Micro-organisms

Bacteria and viruses found in soil and decaying vegetation, and faecal bacteria from sewer overflows, septic tank seepage and animal wastes are common contaminants in stormwater. They can cause water-borne diseases such as cholera, typhoid, infectious hepatitis and a range of gastrointestinal diseases.

5. Toxic organics

Toxic organics include garden pesticides, industrial chemicals and landfill leachate. They may cause long-term ecological damage and danger to human health.

6.Toxic trace metals

Toxic trace metals include lead, zinc, chromium and copper from motor vehicles, pavement degradation, and water pipe and roof corrosion. These pollutants have the greatest potential for chronic impact on aquatic life.

7.Oils & surfactants

Petroleum products such as oil and grease flushed from road surfaces and surfactants from detergents used for washing vehicles in the street are common sources of toxic pollutants.

8.Litter

Litter includes paper, plastics, glass, metal and other packaging materials washed from paved areas throughout urban areas (CEPA 1993, 7-8).

3.1.3.2 The hydrological cycle

The urbanisation of landscapes has profound effects on the natural water cycle. While all types of land development have hydrological consequences, the impact of cities create issues that are distinct from those of other land uses (PCA 2002). In its natural condition, soil is covered with a complex matrix of mulch, roots and pores that absorb rainwater. As rainwater infiltrates slowly into the soil, impurities are cleansed by natural biological processes. Most rainfalls are not large enough to fully saturate the soil, because only a small percentage of annual rainwater flows over the surface as runoff. Runoff usually travels at a slow meandering pace that allows suspended particles and sediments to settle. In natural conditions, the hydrologic cycle creates a stable supply of groundwater, and surface waters are naturally cleaned of impurities (although some sediment is carried with the flow) before arrival into the sea (Bay Water Stormwater Management 1999, 2).

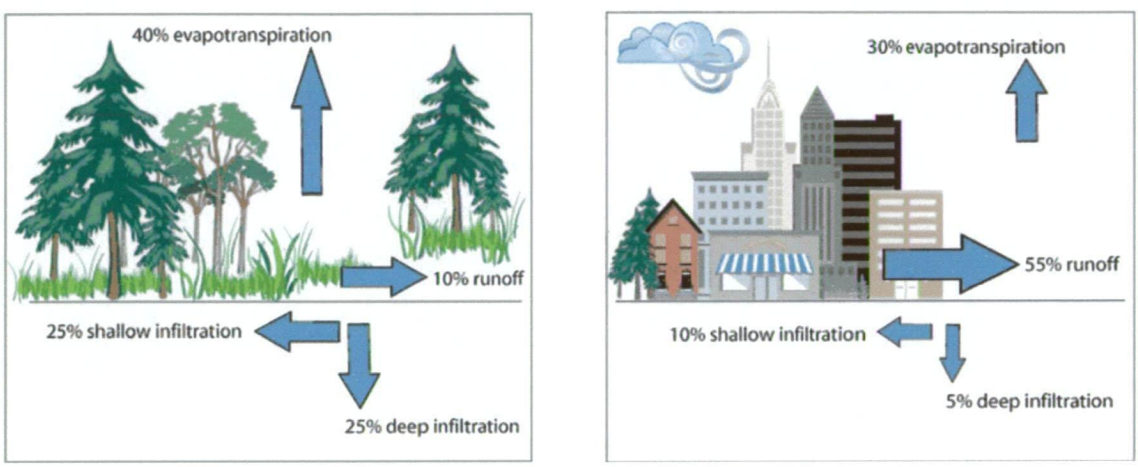
The impact of impervious surfaces on the water cycle often has profound ecological consequences (PCA 2002, 4). As shown in Figure 3.1, the impervious surfaces associated with urban development prevent minimal infiltration of water into the soil. Impervious surfaces are sealed roads; pavements, gutters and building surfaces that do not allow infiltration of water to take place into the soil foundation. Due to the nature of these surfaces, the smallest rainfall can generate a high degree of runoff. This rapid, high volume water flow can have several effects. The most significant of these are discussed below.

1. Increased flood potential

Due to the nature of impervious surfaces, water runoff moves at a much faster rate. Stormwater systems are designed to capture most of this runoff, but urban development

has often outgrown the usefulness of the system that is in place. A backup of water can occur, flooding areas in a low depression as shown in Figure 3.2. Stormwater can also flood into sewer systems, causing them to flood and in turn, releasing untreated sewage into waterways and the ocean (Thomas et al. 1997, 34).

Figure 3.1.Percentage (%) of surface runoff on pervious and impervious surfaces



(Source: Clean Water Education Partnership 2006, np)

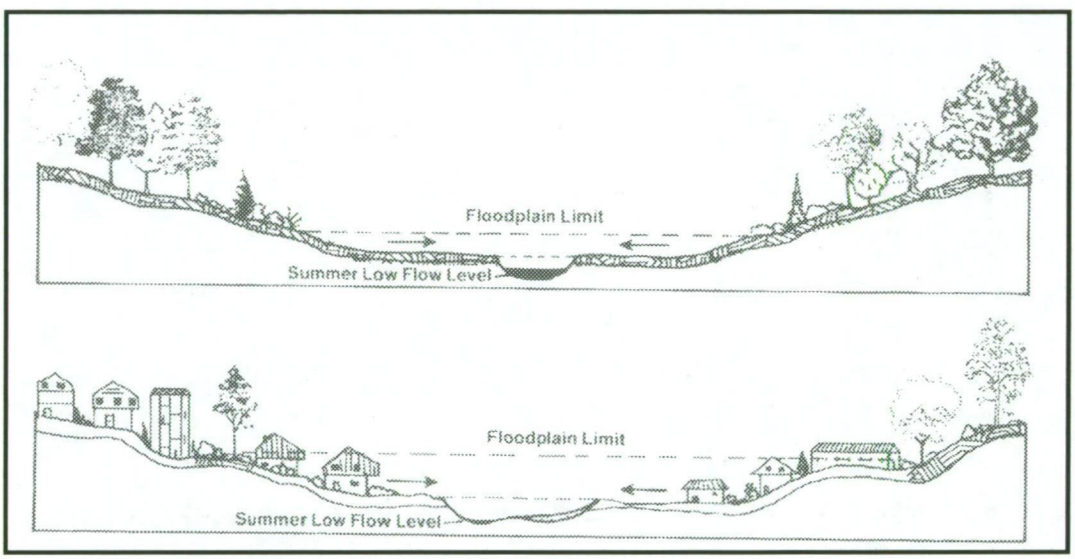
2. Increased Concentration of Pollutants

The primary source for most pollutants is from the atmosphere, in the form of wet-fall and dry-fall. Once deposited onto impervious surfaces up to 90% of the atmospheric pollutants are delivered to receiving waters by runoff (Dept. of Environmental Programs 1987, 14).

A variety of surfaces in the urban landscape are a source of water-borne pollutants. Trace metals are a common component of many urban surfaces, such as flashing and other roofing materials, down pipes, galvanised pipes, metal plating, paints, wood preservatives, catalytic converters, brake linings and tires. Over time, these surfaces

corrode, flake, decay, dissolve or leach out, enabling these metals to wash away in urban runoff. Other sources of pollutants that accumulate and subsequently wash off impervious surfaces include pet droppings, vegetative matter, fertilizers, pesticides, detergents from car washing, oil, grease, litter and other debris (Dept. of Environmental Programs 1987, 14).

Figure 3.2 Floodplain limits before and after urban development



(Source: Dept. of Environmental Programs 1987, 13)

3. Changing groundwater levels

New urban development through drainage, the clearing of existing vegetation and water supply collection can affect the local water balance in complex ways (PCA 2002, 5). The increased use of impervious surfaces in urban areas reduces groundwater infiltration. A consequence of this is that groundwater recharge is reduced and in some cases groundwater aquifers become depleted. Some of the possible outcomes of this reduction of groundwater are summarised below:

- a lowering of the groundwater table can disrupt and, in some cases, eliminate vegetation that relies on groundwater for a source of supply;
- a decreased recharge of groundwater in conjunction with normal levels of contamination can result in increased levels of groundwater contamination, as the contaminants cannot be diluted to less harmful levels;
- a lowering of groundwater levels in clay soils can cause considerable shrinking buildings constructed with foundations in such material will have a tendency to sink and will experience structural damage (OECD 1986, 15).

The PCA (2002) find that the channelling of water away in drains may raise wetland water levels in other places, and, the clearing of vegetation and removal of trees reduces the amount of water drawn up through roots, which can cause water to rise. In some areas, the rising water table brings dissolved salts to the surface resulting in salinity.

Prior to urban development, watercourse flows were sustained by seepage from groundwater released at steady rates after storms (CEPA, 1993). Due to the nature of urban development, infiltration rates have decreased. Impervious surfaces prevent infiltration and rainwater runoff is dispersed into stormwater drainage systems. The most notable adverse effects of a decrease in base flows are:

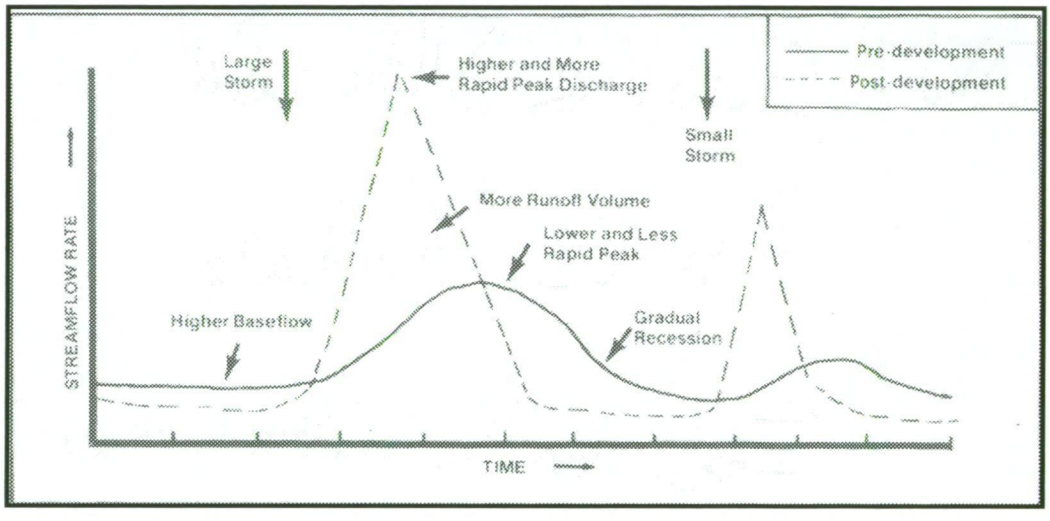
- Reduction of aquatic life.
- Reduced potential for source of water supply for downstream users.
- In semi-arid conditions, reduced base flow rates can contribute to creation of deserts OECD (1986, 15).

Figure 3.3 gives a good indication of base flow rates in streams before and after urban development.

4. Erosion and increased sedimentation in watercourses

Higher flood flows wash off and transport many times more solid materials, such as soil and litter, into receiving waters. Faster flows are more likely to scour and erode the bed and banks of natural channels (CEPA 1993, 13).

Figure 3.3 Stream flow rate pre and post development



(Source: Dept. of Environmental Programs 1987)

The previous discussion has indicated the diverse impacts that stormwater runoff can have on the natural environment. Due to the range of issues presented, it creates a complex problem that requires innovative strategies to address them. One such strategy is discussed below.

3.2 WSUD concept development in Australia

The term, 'water sensitive urban design' (WSUD) was first coined in Western Australia in 1994 (Mouritz *et al.* 2006, 1; PCA 2002, 181; Wong & Eadie 2000, 5). It is

suggested that Whelans et al. (1994) introduced the phrase when they presented management guidelines for WSUD for the Department of Planning and Urban Development of Western Australia (Mouritz et al. 2006, 1; Wong & Eadie 2000, 5).

Initially, the concept of WSUD was seen to embrace a new approach to stormwater management. Wong and Eadie (2000) explain that the concept was based on the formulation of structural plans for urban development that incorporated multiple stormwater management objectives. It offers an alternative to the conventional conveyance approach to stormwater management that seeks to reduce the extent of impervious landscapes and mitigate changes to the natural water balance through on-site reuse of the water as well as temporary retention (Victorian Stormwater Committee 1999, 47). The concept of WSUD has now been expanded to apply at a catchment and regional level. The concept provides the basis for an integrated approach to stormwater management that can deliver a whole range of benefits at both regional and local levels (Wong and Eadie 2000, 5). In its broadest context, WSUD encompasses of all aspects of water management within the urban environment, including water supply, sewerage and stormwater runoff (Mouritz et al. 2006, 2). WSUD is also commonly referred to as integrated urban water management (IUWM) (PCA 2002, 181). The Australian Water Association explains the connections between these two concepts as follows:

> The concept of water sensitive urban design (WSUD) has gained currency in recent years and it neatly encapsulates the holistic approach to reducing the environmental footprint of urban infrastructure. The broader notion of integrated urban water management (IUWM) really means much the same thing, but different groups of professionals have tended to appropriate one other name, according to their cultural orientation. Planners, architects and lateral-thinking developers are probably more aligned to WSUD, while water practitioners as such lean towards IUWM. (cited in PCA 2002, 182)

A review of literature reveals that IUWM seems to be the predominant international term (Bhagwan 2002; Heaney 2002; Savic et al. 2005), while WSUD is the dominant term used in Australia. Regardless of terminology used, it would appear that similar innovative stormwater management practices have been developed internationally in parallel to the WSUD approach since the 1990s (Mouritz et al. 2006, 3).

The underlying aim of this new approach to urban water management is the need to implement more economical and environmentally appropriate ways of providing water, wastewater and stormwater solutions to sustain the water needs of our communities and maintain and protect the habitat of existing ecosystems (Mouritz et al. 2006, 3). The integrated approach embodied by WSUD regards stormwater and wastewater as a resource rather than a burden and considers all aspects of run-off and wastewater re-use including environmental, social and cultural issues within urban planning and management, (Victorian Stormwater Committee 1999, 49). WSUD provides a common and unified method for integrating the interactions of management between the built environment and the urban water cycle.

3.3 Policy framework

The term 'policy framework' refers to a clearly defined set of objectives that are given effect through policy instruments such as mandatory town planning controls (Taylor & Webber 2004, 594). WSUD and associated terminology has been incorporated within planning policies across Australia since the mid 1990s (Mouritz et al. 2006, 4). The driving force behind WSUD policy development in Australia is the National Water Quality Management Strategy (NWQMS). Mouritz et al. (2006) explain that the

NWQMS provides a framework for water quality management that is based on policies and principles that are envisaged as being applied nationwide by state and local government authorities.

Mouritz et al. (2006) indicate that numerous studies around Australia have highlighted major degradation of our urban waterways. These studies have lead to major initiatives being developed in stormwater management, from end of pipe treatments (Gross pollutant traps removing pollutants through physical needs and bio-retention systems removing pollutants through biological and chemical processes) to the adoption and enforcement of several WSUD practices.

As part of this new approach is a land use planning process that will regard water resource management holistically and identify water resource issues early in the planning process (Mouritz et al. 2006, 2). The aim of this approach is to minimise the impact of the natural hydrologic cycle in which the principles can be applied to all aspects of urban design, from a single dwelling to a whole subdivision (Mouritz et al. 2006, 2).

As a policy tool, Mouritz et al. (2006, 4) suggest that WSUD should be seen as essentially having a twofold purpose. First, as a key tool to enable new developments, or Greenfield sites, to be constructed in a manner that enables the recommendations of the NWQMS to be complied with. Secondly, as a way in which 'catchment repair' can be applied to presently developed areas to enable the gradual reduction of the impacts of these areas on urban streams, and the progressive movement of stream water quality toward NWQMS goals.

3.4 Water sensitive design objectives

Mouritz et al. (2006) have articulated a set of objectives of WSUD adapted from the earlier work of Whelans and colleagues in the 1990s. These three objectives are outlined below.

1. To manage water regime:

- maintain appropriate aquifer levels, recharge and stream flow characteristics in accordance with assigned beneficial uses,
- prevent flood damage in developed areas, and
- Prevent excessive erosion of waterways, slopes and banks.

2. To maintain and, where possible, enhance water quality:

- minimise waterborne sediment loading,
- protect existing riparian or fringing vegetation,
- minimise the export and impact of pollution from sewage.

3. To encourage water conservation:

- minimise the import and use of scheme water,
- promote the use of rainwater,
- promote the recycling of wastewater,
- reduce irrigation requirements,
- promote opportunities for localised supply.

These objectives are consistent with guidelines set out by several regional stormwater managing authorities. *The Victorian Stormwater Committee Urban Stormwater Best Practice Environmental Guidelines (1999)*, for example, suggest the following guideline principles:

1. *Protect natural systems*
   protect and enhance natural water systems within urban developments.

2. *Integrate stormwater treatment into the landscape*
   Use stormwater in the landscape by incorporating multiple use corridors that maximise the visual and recreational amenity of developments.

3. *Protect water quality*
   Protect the quality of water draining from urban development.

4. *Reduce run-off and peak flows*
   Reduce peak flows from urban development by local detention measures and minimising impervious areas.

5. *Add value while minimising developing costs*
   Minimise the drainage infrastructure cost of development (Victorian Stormwater Committee 1999, 48).

3.5 Performance comparison between WSUD and conventional stormwater infrastructure

Whilst the environmental benefits of WSUD have been widely recognised, attention should also be paid to the construction and lifecycle costs of WSUD elements, particularly when compared to conventional stormwater infrastructure. Many local government authorities are encouraging WSUD in new developments through its inclusion in planning controls or stormwater policies (Boubli & Kassim 2003, 2). However, a lack of collaboration between council policy makers and administrators often impedes the delivery of WSUD. Fortunately, this barrier has recently been recognised in industry and capacity building programs throughout regional Australia are being operated to address this issue. However, until all councils have been involved in

these programs, the development industry will be subjected to varying WSUD requirements. As Boubli and Kassim (2003) point out, this will result in some developers seeking the easy or conventional solution, others seeking the solution that provides the least impact on the environment and those who will seek the cheapest solution. The construction costs are a significant contributing factor to many developers continuing to apply conventional stormwater design despite understanding the benefits of WSUD.

Research carried out by Coombes & Kuczera (2000) and Boubli & Kassim (2003) has compared construction costs of WSUD infrastructure to conventional stormwater infrastructure. Boubli & Kassim (2003) study focussed on two projects, Pioneer Street in Seven Hills and Heritage Mews in Castle Hill, both in Sydney's North West. The Pioneer Street project was the first in Sydney to combine rainwater tanks, biofiltration trenches and permeable pavers. The Heritage Mews project was a privately funded development that was designed and approved during 2002. It was the first project of a large scale to be developed in Australia to employ rainwater tanks and sustainable stormwater management practices (Boubli & Kassim 2003, 2).

Based on their findings, Boubli & Kassim (2003) found that WSUD was cost neutral on smaller developments such as Pioneer Street when compared to conventional stormwater. The cost savings intensified if the site development was bigger as was the case with Heritage Mews site where an estimated saving of $229,000 was made (Boubli & Kassim 2003, 9).The Pioneer Street cost savings were minimal, as the client for Pioneer Street expressed a preference for having underground rainwater storage tanks. However, a compromise was made which saw some smaller above ground tanks

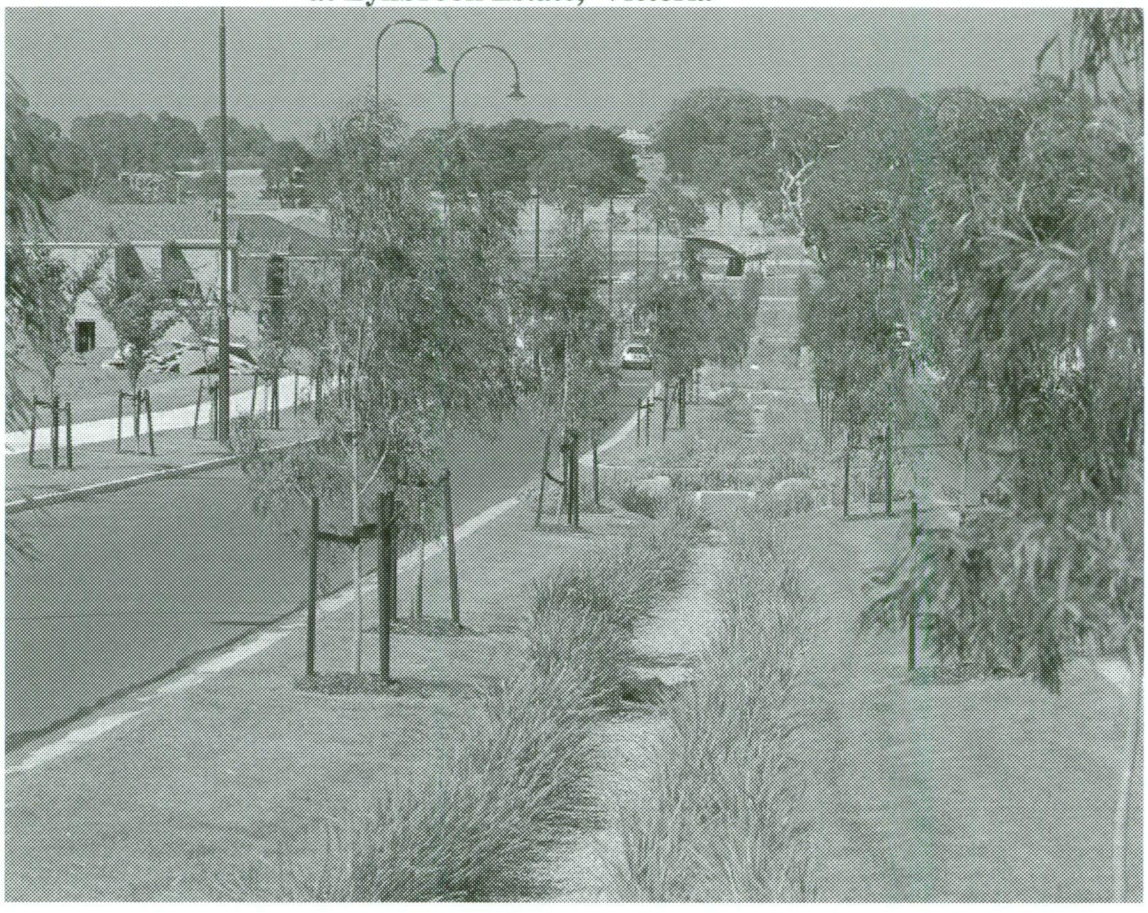
located discretely within courtyards or common areas, out of view of any vehicular or pedestrian access points. This resulted in 75% of the rainwater storage being provided in underground tanks and the remaining rainwater storage was provided in three small above ground tanks. Boubli & Kassim (2003, 7) believe that this scenario was not the most cost effective, but it did satisfy their client's requirements, thus the estimated minimal savings of around $20,000 was made.

The project carried out by Coombes & Kuczera (2000) was a new residential subdivision called Tank Paddock, that drains into the Hexham Wetlands near Minmi, NSW. Environmental damage to the wetlands as a result of urbanisation of this area was a significant concern. The local Council agreed to consider the subdivision proposal if the developer demonstrated that they could mitigate the effects of the development on the Hexham Wetland. Two different solutions were proposed. One solution was a traditional approach that uses kerb and gutters, pipes, pits and detention basins. The other a WSUD approach, used rainwater tanks, contour banks, vegetated filter strips, grass swales and some traditional measures (Coombes & Kuczera 2000, 2).

The WSUD approach resulted in a cost saving of $965,666 or 53% when compared to the traditional approach. The cost savings resulted from a reduction in the use of stormwater pipes, reduced bulk earthworks and reduced detention basin sizes. The WSUD treatment chain of retention storages (rainwater tank, contour bank and gravel trench) create a reduction of peak stormwater discharges that bring about the reduced requirement for infrastructure. The use of rainwater stored in tanks for irrigation, hot water systems and for toilet flushing is expected to result in a 42% reduction in mains water use (Coombes & Kuczera 2000, 8).

In 2000, a collaborative approach between the Melbourne Water Corporation (urban water authority), VicUrban (developers) and the CRC for Catchment Hydrology, was applied to the design, implementation and monitoring of an integrated stormwater management scheme based on WSUD principles and practices. Lynbrook Estate, a greenfield site residential development in the south-eastern growth corridor of Melbourne, was selected to test the benefits of WSUD (Lloyd 2004, 3) A six month paired catchment-monitoring program at the Estate was undertaken to investigate changes in flow characteristics and water quality discharged from a bio-filtration system and a concrete pipe system located in adjacent sub-catchments (Lloyd 2004, 3). Data recorded indicated that the bio-filtration system was successful in preventing urban runoff during 87% of rainfall events (whilst runoff from a conventionally-piped system was observed for all events). Reductions in catchment runoff volume and peak flow were also evident. In addition, gross pollutant load was reduced by 100%; suspended sediment (TSS) by 68%; total phosphorus (TP) by 60% and total nitrogen (TN) by 57%. Pollutant load reductions were attributed to a combination of catchment runoff volume reduction and physical and/or chemical treatment processes. Economic investigation found that bio-filtration systems (see Figure 3.4) provide a 25% saving to the community compared to treating runoff conventionally at a single downstream location using a constructed wetland. More broadly, market research showed that over 85% of homebuyers drawn from Melbourne's growth corridors support the introduction of bio-filtration systems, wetlands and water reuse schemes into their neighbourhood (Lloyd 2004, 1).

Figure 3.4 Bio-filtration system along Lynbrook Boulevard at Lynbrook Estate, Victoria



(Source: Lloyd et al. 2002, vi)

Boubli & Kassim (2003) conclude that WSUD can be delivered on most projects without imposing a financial burden with cost savings likely to be delivered on a larger scale develpments. The achievement of cost effective WSUD will depend on implementing a balance of measures, be they rainwater tanks, biofiltration trenches, swales or permeable pavers, that satisfy the constraints of the site and stakeholders plus the desired stormwater quality and quantity outcomes together with the desired reduction in mains water demand (Boubli & Kassim 2003, 16).

3.6 Conclusion

This chapter has set out to define and assess the positive impact WSUD can have on social, environmental and economic sustainability. The underlying objectives of WSUD are to attain a sustainable use of water and to protect and enhance ecological systems. Studies of existing developments incorporating WSUD have proven that this practice has the capacity to achieve these objectives. Furthermore, the costs involved in the delivery of WSUD are quite competitive, if not, less expensive than conventional stormwater infrastructures. A further plus is the pleasing environmental aesthetics that can be created due to the innovative design of WSUD.

Chapter 4

Capacity building for WSUD

4.1 Introduction

Cloud (2000) believes that contemporary Western societies are very much aware that the longevity of Earth's natural resources are essential to their survival. They hold the health of the planet dear to their hearts, but undermine this health through individual and collective behaviours. Everyday actions often cause personal turmoil and frustration as they contradict environmental values instilled through formal education and processes of life-long learning. Cloud (2000) points out that modern urbanites, in particular, may become disconnected from the places in which they live so drastically that ironically they poison their water, air, and food while at the same time working hard to provide and secure a healthy and meaningful future for themselves and the future of their children. It doesn't make sense.

Can this paradox be overcome? Cloud (2000) argues that societies are aware of the issues of our environment and of our impact on it, but are unclear of the solutions required and how to find these solutions. Education 'for' sustainability is a relatively new approach in environmental education in that it goes beyond addressing the values and attitudes of the individual to build their capacity for instigating and managing change (Tilbury 2004, 103). In December 2002, following the WSSD, the United Nations General Assembly (UNGA) adopted resolution 57/254 to put in place a United Nations Decade of Education for Sustainable Development (DESD), spanning from 2005 to 2014 (UNESCO 2005). Education for sustainability is primarily about values, with respect at the centre: respect for others, including those of present and future generations, for difference and diversity,

for the environment, and for the resources of the planet we inhabit (UNESCO 2005). Education for sustainability enables understanding of the relationship between natural and social systems, and this understanding serves as a durable basis for building respect. Along with a sense of justice, responsibility, exploration and dialogue, education for sustainability aims to move us to adopting behaviours and practices, which enable all, current and future generations, to live full lives, founded on secure provision of basic needs, and embedded with robust self-supporting ecological systems.

Most of Australia's population is concentrated in two widely separated coastal regions. By far the largest of these, in terms of area and population, lies in the south-east and east. The smaller lies in the south-west of the continent. In both coastal regions the population is concentrated in urban centres, particularly the State and Territory capital cities (Trenwin 2001). In general, urban dwellers within Australia have enjoyed a high standard of living including a secure, safe water supply and waste water management over the last sixty years. However, population growth within the urban environment, combined with increasing levels of resource consumption has placed further stress on the infrastructure that maintains these services and on resource supply and the surrounding environment (Foran and Poldy 2002, 8). The water shortage crisis that several urban centres are facing in Australia can be attributed to the above scenario and reduced rainfall (PCA 2005, 85). It is obvious that new innovative strategies need to be adopted to maintain a sustainable water supply. These strategies may already exist, but people are ether unaware of them or lack the capacity to enact them.

AIDA, as described by McKercher (1998) is a popular acronym used in product marketing. It stands for awareness, interest, desire and action. McKercher's explanation

of AIDA can be applied for use in promoting sustainability. The first challenge is to create 'awareness'. Creating awareness of a new practice for enhancing sustainability can be quite challenging for environmental agencies. Convincing the general public or concerned stakeholders of the benefits of a new approach in attaining sustainability can be made easier by adopting a focused promotional strategy that is reinforced through repeated messages (McKercher 1998, 146). The second challenge is to translate awareness into interest. The third challenge is to stimulate stakeholders into accepting that the sustainable practice being promoted will be of a great, direct benefit to them and future generations. The 'interest' and 'desire' stage of the AIDA process are primarily concerned with positioning the sustainable practice favourably in stakeholders' minds (McKercher 1998, 146). The fourth and final challenge is 'action', the stage where stakeholders will adopt that sustainable practice being promoted.

But what is the catalyst for change? Obviously a change in circumstances creates a need to adapt, whether it is economic, social or environmental. Unfortunately, people are not always swift to adapt to change unless it is a reaction to an unfavourable circumstance: for example; increased security at airports since '9/11'. Environmental degradation is certainly not absent from global politics, news media or public debate. The consequences ensuing from it are seen by many to pose a risk to our future livelihood and that of future generations. However many, particularly in developed societies, have placed a good deal of faith and responsibility in science as a source of solutions to global environmental problems. However, scientists alone cannot provide remedies to environmental catastrophes; they also require support from willing, courageous governments, industry and the general populace to create more favourable futures.

Strong inspirational leadership is needed for overcoming environmental problems. Dale (2004) believes that leaders are those who see a problem and take direct actions to solve them. "A leader sees a problem and acts on identifying solutions and making change happen" (Dale 2004, np).

Leadership can be in the form of:

- individuals - such as David Suzuki- renowned environmentalist and author;
- organisations – such as Green Peace, a proactive organisation championing protection of marine species and ecosystems;
- institutional partnerships – such as the Derwent Estuary Program, promoting better stormwater management and environmental practices within the Derwent River catchment;
- international agencies- UNESCO, responsible for facilitating the 'Decade of Education for Sustainable Development'.

To create more sustainable communities, citizens need leaders to initiate awareness, endorse the rewards, break through the barriers, and facilitate the process to attain sustainability.

The level of acceptance by the community, in part, is critical to the adoption of sustainable practices. Sztompka (1996) emphasises the importance of nurturing community trust to ensure a readiness to embrace new technologies (cited in Marks 2004, 206). Marks (2004) advocates that community participation in the delivery of 'more sustainable' urban water management initiatives is now well recognised as an important factor by government institutions (cited in Taylor & Fletcher 2005, 2). Government and non-government participation is critical to achieve any degree of

success in the development and implementation of integrated urban water management strategies. An important factor is that all stakeholders can be involved in all stages of policy making and its implementation. These include: urban planning processes for both problem identification and investigation of options; urban design professions such as architecture and engineering; urban infrastructure building by both government and increasingly, private agencies; and finally, ongoing monitoring maintenance and upgrading.

A collaborative approach to WSUD policy development brings together a wide range of knowledge, perspectives and capabilities. This diverse range of expertise is critical to developing creative solutions that will assist in WSUD policy development and implementation. These stakeholders may represent government departments, politicians, regulatory agencies, experts in the field, science, technology and environmental agencies, industry and business, local councils, interest groups and the general public (Marks 2004, 206).

The remainder of this chapter outlines barriers to the adoption of WSUD before considering three innovative strategies currently being developed to overcome these barriers in Australia. The first of these strategies is the 'Healthy Waterways' Program, an initiative of the Moreton Bay Waterways and Catchments Partnership (MBWCP). This program has identified several barriers that resist the uptake of WSUD by water management professionals and concerned stakeholders. These barriers are evident in Southern Tasmania, and their relevance will be included in the discussion. The second strategy, The 'Clearwater Program' operated in Victoria is highly regarded with its innovative approach to capacity building proving it to be an influential example for

other institutional training providers to follow. The final strategy considered is the Victorian Green Plumbers Program, operated by Master Plumbers' & Mechanical Services Association of Australia (MPMSAA), a professional development program, with a particular emphasis on technologies or practices that promote the sustainable use of water.

4.2 Adopting water sensitive urban design in Water Management and Industry

4.2.1 Barriers to adoption

Many professionals in stormwater management consider WSUD to be current best practice across Australia, but the adoption of this practice is not consistent throughout the profession and associated industries. Morison (2004) believes that this situation is caused by a lack of understanding of WSUD practices, a limited number of demonstration sites showcasing the application and performance WSUD, and a perception that WSUD is more costly than conventional forms of stormwater management. In support of Morison's viewpoint, research commissioned by Healthy Waterways (2004) identified several barriers to the widespread adoption of WSUD principles and practices. The results attained were supported by similar findings made by the Clearwater Program of Victoria (White & Lloyd 2004, 99) and the Cooperative Research Centre for Catchment Hydrology (Lloyd et al 2002, 25). The key barriers identified by these Programs are summarised below:

- a lack of broad policy direction, regulations and guidelines by State Government and local councils, and lack of detail in the approval and administrative process,
- the costs for building, maintaining and replacing WSUD related infrastructure by government and private industry,

- a lack of awareness by stakeholders and the community about the benefits and practicalities of water sensitive urban design, and lack of suitable training programs and access to relevant information,
- an inadequate level of technical skills within industry to design and assess water sensitive development schemes,
- lack of consumer demand for water sensitive design developments, and
- lack of appropriate marketing about their costs, benefits and rewards.

Local government across Australia are generally aware of the benefits of WSUD, although not all the councils are the same in its adoption. A lack of consistent planning and policy frameworks, where clear requirements for environmental performance is regarded, places limits on the use of WSUD. Traditional prescriptive standards, used by local government for controlling development, often lacks the flexibility to accommodate the innovative developments within WSUD (Young 2004, 576). Many local Councils have made changes to their planning policies to encourage WSUD, but there is often a conflict with existing development standards. These policies may not have specified how the WSUD requirements can be met or how development proposals will be assessed (Lloyd et al 2002, 25). This can lead to uncertainty, potential for delays in approvals and conflict between approval authorities.

WSUD is best regarded as a 'grass roots' approach to stormwater management (Dahlenburg 2005, 2). Local councils have primarily been involved in the development of the idea and have often acted as advisers to state governments in regards to development of state planning policy incorporating WSUD (HCC Rep per comm. 2006). Primarily, funding required for developing training programs for staff development is often dependent on State and Commonwealth governments. Healthy Waterways (2004) identified that political and senior management support for WSUD

was not always high in terms of political priorities and therefore does not translate into action or government funding. It is also suggested that the inertia among senior bureaucrats is due to an inherent conservatism or lack of political will.

The costs associated with the installation of WSUD infrastructure and its long-term maintenance is often seen as a major obstacle by industry stakeholders and local councils. Many developers perceive the installation of WSUD infrastructure not to be cost-effective compared to traditional stormwater infrastructure. This misconception was discussed in Chapter 3. Some smaller councils see the ongoing maintenance costs to be a burden on their fiscal resources (Boubli & Kassim 2003, 1; Coombes et al 2000, 4; Healthy Waterways 2004, 7).

The lack of availability of technical expertise and information required for successful WSUD can be a limiting factor in its implementation. Adequate technology does exist to address the challenge of WSUD; however, the topographic, geological and geographic elements of different sites present problems for the design approach. Lifecycle evaluation of the structural integrity of WSUD technologies and their long-term cost effectiveness is also an issue. Due to the relatively short operative time of some WSUD developments, it has been difficult to attain a true assessment of the success of this practice.

The final key barrier is that of social demand and consumer affordability. The findings presented by Healthy Waterways (2004) found that consumer demand for water sensitive developments is not currently widespread in the community. The goal of WSUD, and any associated infrastructure costs, is likely to appeal to higher socio-

economic groups who are environmentally motivated. The promotion of WSUD to such groups could be like 'preaching to the converted' as these consumers require little incentive to adopt WSUD practices. However, Nancarrow et al. (2004) argues that a price increase in water use would have little effect on water use on high-income earners. For example, in Perth, 10% of people use 30% of the water and this is the higher socio-economic group (Nancarrow et al. 2004, 232). This particular group has the earning capacity to absorb the cost of water price increase, without changing their lifestyle. However, price increases would certainly affect the lifestyle of lower income earners.

Water reuse systems have been a popular approach promoted by councils throughout Australia (Ryan & Brown 2000, 2; Marks 2004, 208; Nancarrow et al. 2004, 232). The use of rainwater tanks and greywater reuse systems for toilet flushing and garden irrigation are seen as effective means of preserving potable water reserves. However, as Marks (2004) points out, economic incentives for installing these systems are very limited. Rebates received represent a fraction of the true cost of the systems installed.

4.2.2 Capacity for WSUD in Derwent Estuary councils

Quantitative findings in this study found five councils within the Derwent Estuary to be inconsistent in the inclusion of WSUD principles within their Planning Controls and policies. Table 4.1 illustrates this point. Further discussion held with targeted informants within the councils indicated some awareness of WSUD, but varied in their understanding of its principles and usefulness.

Brighton Council is proactive in the facilitation of WSUD within its planning controls. It encouraged the use of WSUD in a new development in 2002 and is looking to make

WSUD the default approach in stormwater management. It also supplies water tanks at a discounted price and discharges the costs of plumbing permits required for their installation.

Hobart City Council has displayed some initiative to support some WSUD principles. A water conservation rebate scheme was introduced in 2003. This was a financial incentive to encourage the installation of water saving fittings within the household and the installation of rainwater tanks, for use in backyard irrigation or for toilet flushing. No statistics are available indicting the uptake of this scheme within the Council's municipality. They are on the verge of releasing WSUD guidelines for use by developers, landscape designers and architects. However, support for WSUD is lukewarm amongst some departmental staff. Several officers believe the use of WSUD is limited within the municipality of Hobart due to the lack of greenfield development sites.

Glenorchy City Council encourages WSUD as part of their sub-division planning application policy but does not enforce it. Clarence City Council has not incorporated it into planning their schemes and is not planning to at this stage. They will consider it, if initiated by a developer. WSUD retrofits were not supported as water seepage into neighbouring properties was held as a concern.

Kingborough Council are overseeing a current WSUD development in Snug, south of Hobart. The use of WSUD was initiated by the developer. The council is supportive of it, however, they wish to have a footpath built and this is causing some design issues for the developer.

One prominent theme came to the surface during the conservations held with these informants. Several mentioned a lack of time in their position and limited professional development opportunities made it difficult to get a grasp on their authority's policy on WSUD.

4.2.3 Strategies to address barriers

It is arguable that policy and regulation in regards to WSUD is inconsistent throughout water management institutions in Australia. Healthy Waterways (2004) survey participants believe the best solution to resolving these issues is to make water sensitive urban design compulsory with stronger legislation, new regulatory guidelines and realistic enforcement procedures. A uniform and united approach by different levels of government would improve the streamlining of the approval process. Town planning controls are the primary policy instrument able to promote WSUD, but these controls can be ineffective unless they are supported by high-level policy endorsed at all levels of the political process (Taylor & Webber 2004, 594). Furthermore, discrepancies in the understanding of WSUD principles exist within different levels of government. The introduction of national policy and legislation on WSUD by Commonwealth and State governments would encourage local governments to modify their existing planning schemes to incorporate WSUD as an integral part of their environmental and town planning policies.

Table 4.1 Planning and policy capacity for WSUD in Derwent Estuary councils

	Planning and policy capacity for WSUD in Derwent Estuary councils *					
	Leading question asked of targeted informants: Has your council carried out, or is planning to carry out, any of the recommendations in the following checklist that benefit the whole municipality?	Kingborough	Glenorchy City	Hobart City	Clarence City	Brighton
1	Require WSUD practices as a standard development application (DA) information for all requirements.	no	yes	unknown	no	yes
2	Lead by example and require WSUD in all council developments.	no	yes	unknown	unknown	unknown
3	Detail in the next strategic plan how WSUD will be adopted by council, both on-ground and in frameworks.	no	yes	yes	no	unknown
4	Develop a WSUD Policy or planning guidelines detailing council requirements for WSUD practices.	no	yes	yes	no	yes
5	Include WSUD in any revision of the planning scheme, referring to planning or technical guidelines for detail.	unknown	no	yes	no	no
6	Ensure that council staff and developers understand the WSUD requirements throughout the DA process.	unknown	yes	yes	no	yes
7	Require developers to assess land suitability, erosion potential and potential impacts on water quality and bushland in a detailed environmental impact assessment (EIA), as part of the DA process.	yes	yes	yes	yes	yes
8	Support a WSUD demonstration site at a sub-division to promote WSUD practices in the municipality.	yes	yes	no	yes	yes

(* Questions adapted from Model Stormwater Plan DEP 2002)

The economic benefits of WSUD (Lloyd 2004) are not always obvious and are often difficult to quantify. Due to their complex nature, assigning a true dollar value to ecologically diverse and healthy ecosystems is extremely difficult. Examination of

capital cost, ongoing maintenance costs and externality costs are required to fully appreciate the benefits of treating stormwater using a WSUD approach, compared to traditional conveyance and end of pipe treatment approaches. One of the key strategies in overcoming this misconception is through education and training programs. To increase their awareness and understanding water management professionals need to be exposed to WSUD demonstration sites that allow for comparison of the cost factors in its implementation with traditional methods. Furthermore, case studies comparing the costs of WSUD and traditional stormwater are available and give a clear indication of the economic benefits of WSUD (see Coombes & Kuczera 2000; Boubli & Kassim 2003; Lloyd 2004).

The costs involved in providing professional development training for staff can place a financial strain on council budgets. Smaller councils often lack the resources needed to train staff. The problem increases when staff turnover is high and inexperienced staff needs to be trained also. There are currently in Australia a range of methods and tools that can be used by local authorities to deliver education for sustainability programs within their own establishment and the wider community (Tilbury 2005a, 1). The motivation and the ability of the community and water management professionals to participate in the processes for sustainability are predominately dependent on the type of approach used. Some local authorities struggle to act on initiatives due to a lack of staff training or workplace support. A network approach as set up by the Clearwater Program in Victoria allows councils and other institutions to minimize their expenditure and share resources enabling effective training programs in WSUD to take place. A key tool of the network is an information exchange website that allows local government

authorities throughout Australia to share information and make contact with other water management professionals.

The Clearwater Program addresses both communication and water management issues in its capacity building program. It recognises that sustainable urban water cycle management must consider rainwater, stormwater, wastewater and greywater collectively, not as separate entities (White & Lloyd 2004, 99). For this reason, training programs to promote WSUD must be tailored to a range of professionals across all council areas and associated industries. In doing so, an opportunity will exist to engage a wide and diverse and often entrenched audience (White & Lloyd 2004, 100). This approach will allow organisations such as councils to build closer partnerships between departments through the dissemination of specialist technical information and advice. This too, could be applied across neighbouring councils via a municipal network.

4.2.4 Application of strategies to overcome barriers-a case study

Throughout Australia capacity building programs exist that aim to provide participants with knowledge and skills required to address certain issues within their particular profession or industry. Brown (2004) advocates capacity building as a concept for mobilising institutional change. "It spans a range of fields in different guises including public management, collaborative planning, urban sustainability and development studies including public management" (Brown 2004, 2). The Clearwater Program in Victoria was developed in 2002 as a state-wide capacity building program for local government and industry professionals, supporting the sustainable management of urban stormwater. This program is highly regarded by other professionals as an effective instrument in facilitating the adoption of WSUD to water management

professionals and the wider community (HCC Rep pers comm. 2006 & DEP Rep pers comm. 2006).

In the initial development stage of the Clearwater Program, external market research consultants were utilised to gather information from local government and industry professionals across Victoria on issues relating to the implementation of sustainable urban stormwater management. Outcomes of the research identified a number of common perceptions, drivers and barriers to urban stormwater management as well as key information needs for particular professional disciplines. These were:

- gaps in urban stormwater best practice knowledge and awareness;
- barriers to the implementation of best practice;
- key target audiences;
- gaps in training, internal support facilities;
- preferred avenues for communication, education and training (White & Lloyd 2004,100).

As a result of these findings, the program was developed to meet the information, education and training needs of local government and industry professionals. A framework (see figure 4.1) was created that outlines the key communication and issue areas to be addressed through the delivery of tailored events and dissemination of information and resource packages.

The framework outlines the need for capacity building in two key areas:

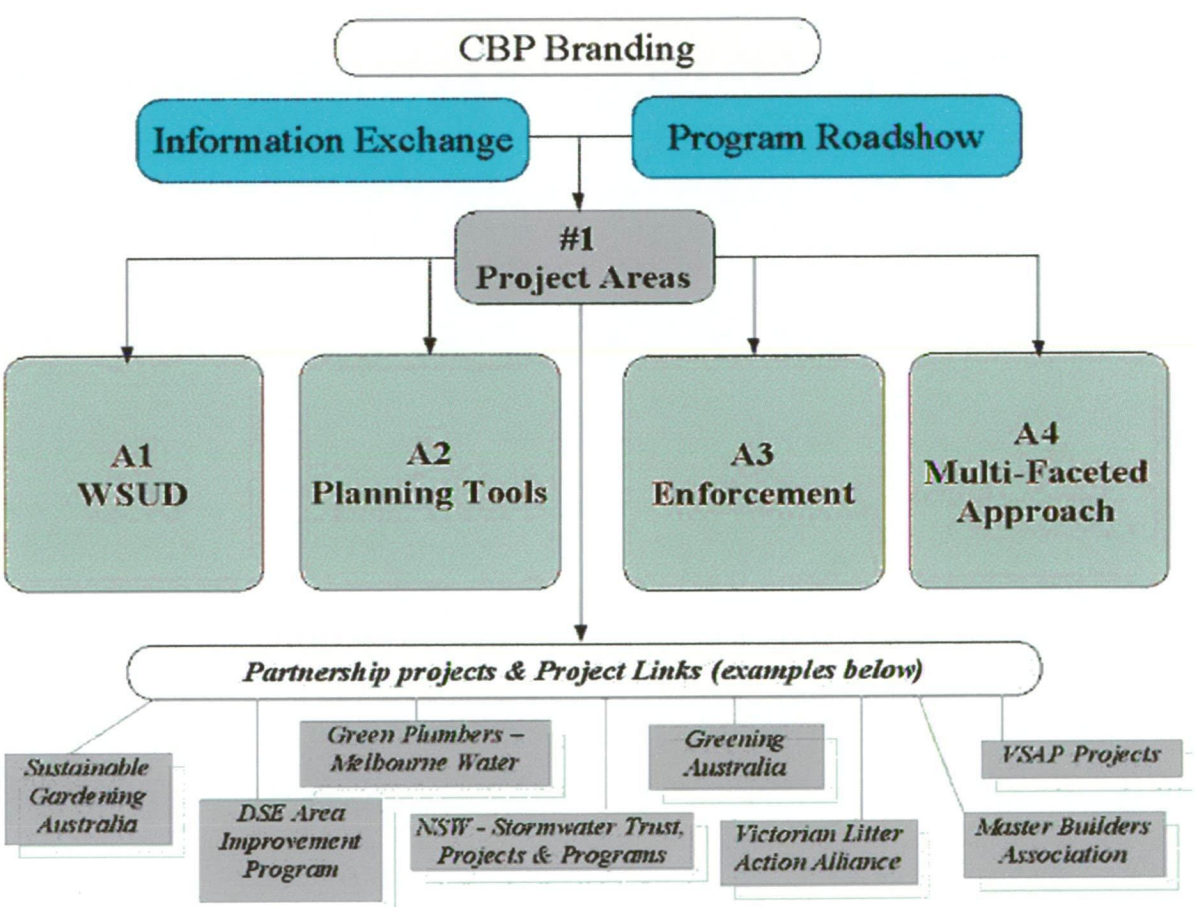
1. Communication:

- Information exchange and dissemination
- Roadshows – networking
- Specific project areas:
- Water Sensitive Urban Design

2. Planning Tools

- Regulation and Enforcement (building site management, subdivision controls, etc)
- Leadership

Figure 4.1 Clearwater Program Framework



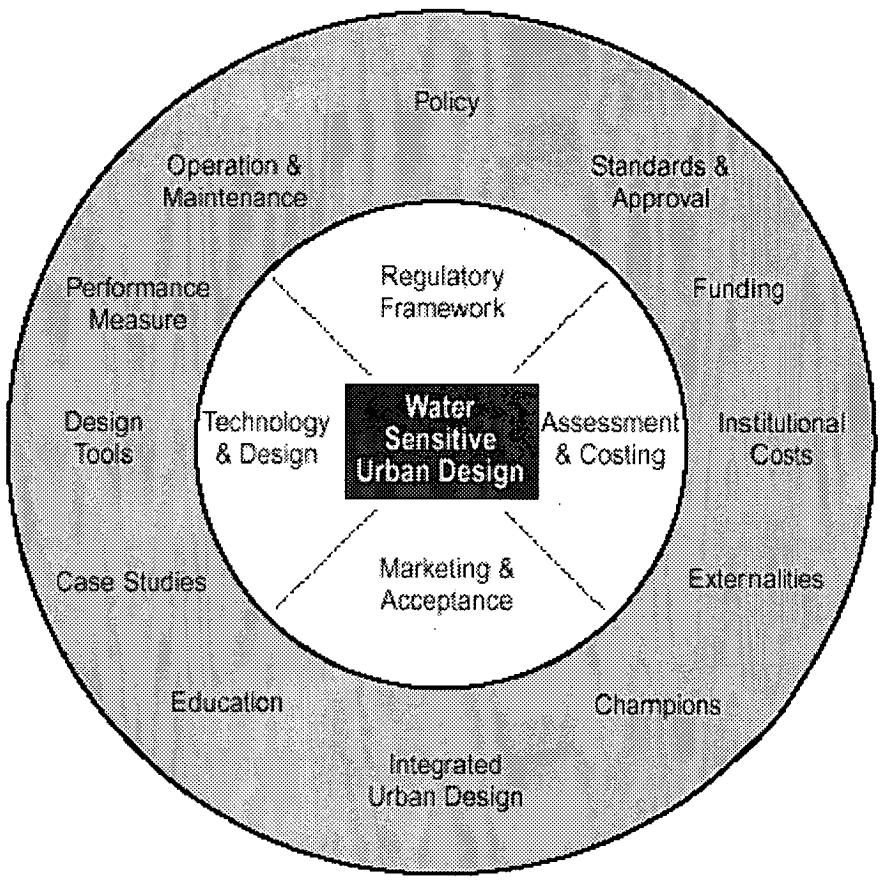
(Source: Clearwater 2004, np)

The adoption of WSUD challenges local government and industry to move beyond existing planning policy and conventional water engineering approaches. Through a series of presentations, workshops, site visits and tailored training sessions, the Clearwater WSUD Program has delivered a number of unique projects and activities that have provided industry and local government professionals with the knowledge and skills to support sustainable watercycle management, removing barriers to the adoption of WSUD.

The Clearwater WSUD Program framework delivers information via education and training targeting four key areas of WSUD. These being: (1) regulatory framework; (2) assessment and costing; (3) marketing and acceptance; and (4) technology and design. Figure 4.2, illustrates the key components of this framework in incorporating WSUD into urban development projects.

Four learning approaches adopted by the Clearwater Program reflect the four broader learning for sustainability approaches defined by Tilbury & Cooke (2005c) in the *Frameworks for Sustainability* document: namely; mentoring, facilitation, action learning and action research. In participating in the Clearwater Program, individuals and groups are provided with support, advice and understanding to engage in concept of WSUD and the broader spectrum of sustainable urban water management. The program encourages interaction on the part of learners via forums, workshops, and market research. It equips the learner with the necessary skills and knowledge to take action and participate in social change and decision-making. It develops the ability of people to 'critically' reflect on their existing practices and identify practical pathways for the

Figure 4.2 Clearwater WSUD Program Framework



(Source: White & Lloyd 2004, 106)

change. The process encourages people to engage in lay-expert dialogues, whereby they can learn from each other and not be intimidated by expert knowledge. WSUD forum participants are given the opportunity able to develop an action plan on future training events and methods of delivery. This provides the Clearwater Program with an indication of what information or training is required, where and by whom. Through a combination of planning, action, observation and reflection, program participants are

encouraged to explore ways in which they can make changes in their work practice and within their organisation, and in everyday life.

Evaluation results made available in 2004 suggest that the Clearwater Program has largely met the expectations and needs of the target audiences (White & Lloyd 2004, 106). The program content has been to encompass more complex issues and more educational strategies. A key role of the program has been to facilitate the creation of partnerships and networks across Victoria disseminating knowledge and building the institutional capacity of local government and industry to be leaders in sustainable urban water management.

Brown (2004) points out that capacity building programs may equip individuals with new knowledge, skills and professional competencies, but that the organisational structure and culture of their workplace will often impede their ability to implement more sustainable practices. A review of literature by Brown (2004) indicates that local government capacity for providing effective, efficient and responsible governance towards sustainable urban water management is dependent not only on well developed human resources but also sufficient capacity within organisational and directive contexts. Brown (2004) argues that human resource development needs to occur across several departments to engage the principles of sustainable urban water management. A collaborative approach between all departments would best provide the local authority with the capacity to implement an effective approach to integrated urban water management.

Table 4.1 featured below displays the three key elements of capacity building: human resource management, organisational strengthening and directive reform. However, the extent and durability of capacity building is not just the sum of these three elements. Rather, the relationship between these elements will determine the resulting patterns of institutional change (Brown 2004, 2).

Table 4.1 Dimensions of capacity building

Capacity Building	Description	Interventions
Human Resource development	Equipping individuals with the understanding, skills and access to information, knowledge and training that enables them to perform effectively	e.g. recruitment and training
Organisational Strengthening	Elaboration of management structures, processes and procedures, not only within organisations but also the management of relationships between the different organisations and sectors (public, private and community).	e.g. incentive systems, leadership, communications
Directive Reform[1]	Making legal and regulatory changes to enable organisations, institutions and agencies at all levels and in all sectors to enhance their capacities.	e.g. policy and legal change, constitutional reform

(Brown 2004, 3)

4.3 Green Plumbers

The Green Plumbers program began its operation in Victoria 2001 as an initiative of the Master Plumbers and Mechanical Services Association of Australia (MPMSAA). In that time it has provided professional development for 3800 plumbers and sales staff. Their vision is to promote more environmentally sustainable ways of operating within the urban environment (Green Plumbers 2005)

Green Plumbers work in a collaborative manner with local government and industry throughout Australia to promote their program. One such partnership is with the

Victorian Government's initiative 'Our water our future'. This is an action plan to enable smarter water use and management across the State of Victoria (Southeastwater 2005). Another partnership commenced in 2005 with GoldCoast Water's 'Water Saver Program'; that aims to promote water conservation throughout their region (Hillier pers comm. 2006).

The material used in the training program was developed by the Training Centre for Infrastructure Technology located at RMIT and delivered by MPMSAA. Funding to operate the program is provided through State government sources. Training is provided free to the participating plumbers.

The training program has four themes; climate care, caring for our water, solar hot water and water reuse. Caring for our water and water reuse are of particular relevance to this study as they focus on water sustainability, stormwater management, water conservation, water efficient products, water recycling opportunities, greywater reuse and international technology & developments.

Plumbers are notified of training opportunities via flyers that are mailed to them during various times of the year (Hillier pers comm. 2006). Training programs are also advertised in industry literature (Anon plumber pers comm. 2006). Information could not be attained on the length of each particular course, but one informant indicated that the course he attended with nine others was from 9am till 4pm (Anon plumber pers comm. 2006). An informant who participated in the 'Caring for Water' course could not recall any specific detail in regards to WSUD practices or principles. He also described the course as theoretical rather than practical (Anon plumber pers comm. 2006).

A further incentive for course participants is their inclusion on a web-based database on completion of their course. Potential clients can view details of their qualifications, contact details and their location within each State. This information can be easily accessed via the Green Plumbers web site or through telephone enquiries to them.

The informant in this study regards himself to be proactive in developing his plumbing business. He does not regard himself to be a conservationist, but regards water conservation as a growth industry for his business in the future. This is the main motivation for him in participating in professional development courses such as these (Anon plumber pers comm. 2006).

4.4 Conclusion

This chapter has described the major barriers that impede the adoption of WSUD as the default urban water management approach across Australia. The chapter then introduced three strategies currently underway to overcome these barriers. However the inertia of many local authorities and industry to adopt WSUD still seems to be the main barrier to its implementation.

To gain a better understanding of the complex processes involved in building institutional and social capacity for WSUD, the next chapter develops a detailed case study of an institutional partnership promoting WSUD to the Southern Tasmanian Community.

Chapter 5

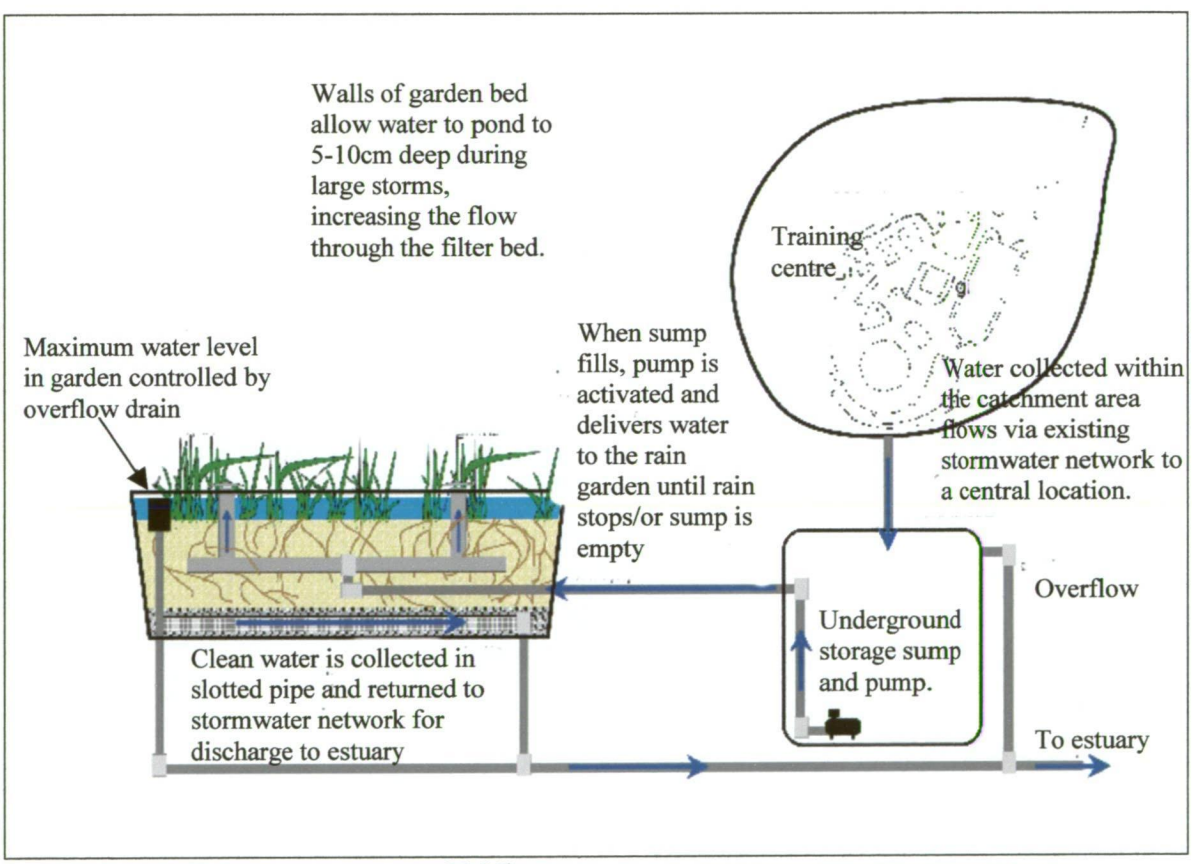
Case study of a project partnership promoting WSUD in Southern Tasmania

The project partnership that forms the focus of this chapter comprises four agencies: Hobart City Council (HCC), Royal Tasmanian Botanical Gardens (RTBG), Derwent Estuary Program (DEP) and the Masters Plumbers Association of Tasmania (MPAT). A key objective of the partnership is to promote and facilitate the use of WSUD within the Southern Tasmania. Each agency had initiatives already in place to promote the implementation of WSUD and water conservation measures. However, the project partners believed a highly visible demonstration site was required to promote the principles of WSUD to the community. Funding received from the Australian Envirofund in 2004 provided the opportunity for all four to combine their resources and expertise to develop such a project in the RTBG.

A rain garden was chosen to be the centre-piece of this project. The rain garden provides an example of a storm water treatment/retention system that is regarded as a best management practice (BMP) in water sensitive urban design literature and engineering manuals (DEP 2005; Melbourne Water 2004; NRDC 2001). It is commonly classified as a 'bioretention basin' (DEP, 2005; NRDC 2001). A bioretention basin is a system that provides efficient treatment of stormwater through fine filtration, extended detention and some biological uptake. The RTBG rain garden (see figure 5.1) harvests water from the training centre roof and the surrounding roads and pathways into a small basin, or pond, planted with native vegetation. The water is filtered by micro-organisms that live around the root zone of the plants and then percolates through the sandy soil

layer at the base of the pond (RBTG 2006, np). A combination of plant take-up and microbiological interaction removes pollutants from the water. The silt load is also reduced due to the Rain Garden's ability to slow down the water before it is returned to the Derwent River (RTBG 2006, np). Apart from its water cleansing properties, this project was also designed to demonstrate the aesthetic qualities of such systems and their ability to be fitted into a variety of urban settings (RBTG 2006, np). (See Figure 5.2)

Figure 5.1 Rain garden system and design at Royal Tasmanian Botanical Gardens



(Source: MPAT Rep pers. comm. 2005)

All parties involved in this partnership have benefited from the sharing of knowledge and technical expertise between the four agencies. The partnership continues to develop initiatives to further promote WSUD in the community. This partnership did not come

about by accident. To best understand the origins and development of this strategic partnership, the following section reviews the history of this partnership and the motivation of each agency in becoming involved. The chapter concludes with an evaluation of the project's effectiveness.

Figure 5.2 WSUD Demonstration site – 'rain garden'- RTBG.

(Source: Hyland 2006)

5.1 Evolution of agency's motivation in sustainable water management practice

5.1.1Policy influence

The process for achieving water quality management within Southern Tasmania has been based on national guidelines provided by the NWQMS 1994. State and local governments have applied the principles of the NWQMS within planning policy and objectives to achieve sustainable outcomes in water management.

The Tasmanian State Policy on Water Quality Management (1997) identifies stormwater management as a priority where stormwater pollution may impact the quality of receiving waters. The policy places an expectation on local governments to prepare stormwater management plans in high priority areas in accordance with the NWQMS (see Chapter 3), which lists WSUD as a preferable means of managing stormwater (DEP 2005, 1-3)

5.1.2 Hobart City Council

As one of the stakeholders in improving water quality management, Hobart City Council has adapted the principles of the NWQMS in their *Strategic Plan for 2001-2005.* In Key Area 6 of this Strategic Plan, HCC highlights two strategies directly related to the national water reform agenda.

> Key area 6:
> 6.1.1
> continue active participation in the Derwent Estuary Program to develop and implement environmental management strategies to achieve water quality objectives for the Derwent River and Council's waterways.
>
> 6.1.8
> continue to participate in the national water reform agenda (HCC 2003,17).

Hobart City Council released its own water reform package in June 2001. The paper presents the argument that water reform should be used to facilitate public education and action to adopt a sustainable use of water resources, and employ practices to preserve local ecosystems and marine environments (HCC 2001, 5). The paper provided the Hobart City Council with four mechanisms of reform required to bring it in line with the national water reform objectives: physical environmental sustainability

initiatives; financial reform; institutional reform and sustainability; and public health issues. Initiatives for sustainable water management identified by HCC included: greywater reuse, groundwater issues, water sensitive design and harvesting, roof water reuse, on-site stormwater detention, treated sewage effluent reuse, and catchment management and impacts on waterways.

HCC's water reform package also discussed the prospect of a rebate system to encourage the use of low water use/reuse devices and the development of an educational package promoting water conservation. As part of its Strategic Plan 2001-2005, Hobart City Council has introduced several programs that support the proposals published in the water reform package. These include a water rebate scheme; an education package that focuses on water conservation in the home; a rainwater tank advisory service; and two education publications targeting primary aged children, focusing on the prevention of pollutants entering the Derwent Estuary via stormwater. The HCC has also undertaken several stormwater improvement programs including:

> *Hobart Docks & Salamanca Stormwater Improvement Project - 2001 / 2002*
> This project involved the trial and installation of various 'at-source' stormwater entry-pit litter traps. The project has helped Council assess the most suitable ways to stop litter reaching the stormwater network and the Derwent Estuary.
>
> *Wayne Rivulet Catchment Management Plan & Contaminant Removal Device - 2001 / 2003*
> With the aid of the Federal Government's Natural Heritage Trust funding, Council developed a catchment management plan (CMP) and installed two pollutant removal devices in Lower Sandy Bay.
>
> *Cornelian Bay - An integrated approach to stormwater management – 2003*
> Another joint-funded project in which Council designed a stormwater 'treatment train' to improve the quality of stormwater draining to Cornelian Bay.

Clean Stormwater Practices in Hobart City – 2003
Under a joint-funded project, Council installed various stormwater quality improvement devices around Hobart CBD and prepared a CMP for the Hobart Rivulet.

New Town sediment weir & trash rack – 2003
To reduce accelerated siltation in New Town Bay, Council installed a sediment-trapping weir on the New Town Rivulet. The weir features a trash rack to catch floating debris before it reaches the Bay.

New Town wetlands - 2001 / 2002Inland Wetland/ Estuarine Wetland
Two artificial wetlands were constructed to accelerate bioremediation of contaminated sediments in New Town Bay (HCC 2005, np)

As part of its strategic plan, HCC also recognises the importance of establishing and developing "linkages and partnerships with other levels of government, business and community to ensure a community-wide response to environmental management issues" (HCC 2001, 5).

Acting on this recognition, Hobart City Council has become involved in a range of partnerships that promote sustainable use of our natural resources and the preservation of our ecosystems and natural habitat. One of these is their participation in the DEP and in the WSUD project.

5.1.3 Derwent Estuary Program

The DEP was initiated in 1999 as a joint State, Local and Commonwealth Government program to restore and protect the Derwent Estuary (DEP 2006, np). The program was initially designed to address environmental quality issues such as industrial and urban water pollution, contaminated sediments, introduced species and loss of estuarine ecosystems. More recently, foreshore issues have also been incorporated within the

program (DEP 2006, np). The Derwent Estuary Program was formalised via a Partnership Agreement between the Tasmanian State Government and six Local Councils that border on the estuary: Hobart City Council, Glenorchy City Council, Kingborough Council, Clarence City Council, Brighton Council and Derwent Valley Council (DEP 2006). A Memorandum of Understanding committed the parties to participating in a strategic planning process and the development of management framework over a two-year period. This culminated in the signing of an implementation partnership agreement committing Local and State Governments to the implementation of the management plan (DEP 2006, np)

The State Policy on Water Quality Management 1997 has influenced the development of several stormwater projects undertaken by the DEP. The purpose of the policy is to attain sustainable management of the state's surface and ground water resources by protecting or enhancing their qualities while allowing for sustainable development inline with the objectives of Tasmania's Resource Management and Planning system (Tasmanian Government 1997, 10). With regards to urban runoff the policy stipulates the following:

> *33.* Urban runoff
> 33.1
> Regulatory authorities must require that erosion and stormwater controls are specifically addressed at the design phase of proposals for new developments, and ensure that best practice environmental management is implemented at development sites in accordance with clause 31 of this Policy.
> 33.2
> State and Local Governments should develop and maintain strategies to encourage the community to reduce stormwater pollution at source.
> 33.3
> Where urban stormwater runoff is prejudicing, or has significant potential to prejudice, the achievement of water quality

> objectives, councils should prepare and implement a stormwater management plan consistent with the principles and methodology set out in *Guidelines for Urban Stormwater Management*, publication 10 of the National Water Quality Management Strategy.
> 33.4
> Councils should carry out an assessment of the need for stormwater management plans in respect of stormwater discharges within their jurisdiction, and provide a report on this assessment to the Board within 3 years of the making of this Policy. The assessment should also be reported in the council's annual report (Tasmanian Government 1997, 10).

In 2001, the Derwent Estuary Program formed a Stormwater Task Force and employed a Stormwater Officer to encourage stormwater management on a more regional scale. Two roles of the Task Force and the Stormwater Officer are to:

- review stormwater management initiatives around Greater Hobart and share management experiences; and
- encourage councils and the community to adopt practices that reduce stormwater pollution, including Water Sensitive Urban Design, education and source controls (DEP 2006, np).

This intiative culminated in the development of a model stormwater management plan outlining preventative measures available to reduce the impact of stormwater pollutants flowing into urban creeks and the Derwent estuary. The Plan provides practical ways that local government and the community can minimise this pollution (DEP 2006, np). It identifies housing development, erosion, industries, sewage systems, litter and roads as major sources of stormwater pollution. It recommends additional community and industry education about stormwater, revegetation of urban creeks and the installation of structured treatment trains that include devices that capture litter at source and treat the

water through bioretention, these removing solid and biological pollutants (DEP 2006, np). The Plan also encourages councils and developers to adopt water sensitive housing development in urban areas to reduce stormwater runoff and pollution.

The DEP has played a vital role in promoting a more holistic approach to urban water management. The *WSUD Engineering Procedures for Stormwater Management in Southern Tasmania* was launched by the DEP in 2005. This is an excellent technical manual, which provides guidelines for the implementation of WSUD infrastructure. HCC membership of DEP saw the two combine to play a vital role in the conception and implementation of the WSUD demonstration site.

5.1.4 Royal Tasmania Botanical Gardens

The RTBG completed a five-year Strategic Plan in early 2003. The mission is to manage, conserve and enhance the RTBG by delivering sustainable and relevant programs in plant collections and displays, tourism and recreation, cultural heritage, research, and learning for Tasmania and the broader community (RTBG 2003, np).
Water use is a key concern in the management of the RTBG, which saw a 50% increase in water expenditure between 1998 and 2005 (RTBG Rep pers. comm. 2006).

The RTBG have continued to search for new strategies to reduce their water consumption. The WSUD demonstration site was regarded as a significant opportunity to pursue initiatives that may help reduce their water consumption in the future and to meet the needs stipulated in their Strategic Plan (RTBG Rep pers. comm 2006). One of the eight goals identified by the Strategic Plan 2003-2007 is to be a community leader in

sustainable environmental programs, promoting the development of social and environmental awareness to the community. There are few examples of WSUD within Tasmania and the RTBG saw this project as an opportunity to play a lead role in its development (RTBG Rep pers. comm. 2006).

5.1.5 Master Plumbers Association of Tasmania

The key objective of the World Plumbing Council (WPC) is to unite the world plumbing industry in the task to safeguard and protect the environment and the health of nations for the benefit of all (WPC 2005, 1). Several strategies are listed by the WPC to achieve this objective, but the most relevant to this study are:

- Promote and provide assistance on matters concerning education and training in the plumbing industry, recognising the need for appropriate standards and their international recognition.
- Create an awareness of the plumbing industry's role in protecting the environment by the provision of water and sanitation through proper management, care, reuse, and conservation of natural resources.
- Provide and share information regarding research projects and technology applicable to the plumbing industry and the people it serves (WPC 2005, 1)

MPAT Tasmania have actively applied these strategies within the Tasmanian Plumbing profession since their inception 58 year ago and continues to do so. In 2003, in partnership with the HCC, MPAT conceived the Green City Services program. A significant influence in the conception of this program was the 'Green City Denmark' program.

Currently, the Green City Services environmental program is based on the long-term goal of improving the sustainable use of our natural resources. It aims to nurture close co-operation between municipalities, industry and the public in moving towards a more ecologically sustainable society (MPAT 2006, np). This program provides plumbers with professional development (PD) opportunities, providing them with the knowledge and tools to respond with the most environmentally appropriate product to a customer's needs. It offers clients the opportunity to be served by a plumber who has completed additional professional development, giving assurance that the decision made will not only be better for the environment but may also be better in terms of a household's costs MPAT 2006, np). A key principle of Green City Services is to work with other institutions and the community in a collaborative manner to achieve sustainable outcomes in the environment. MPAT's water conservation training modules have provided plumbers with the qualifications to act in an advisory role to clients wishing to conserve water within the household. Householders living within the HCC municilpality can receive rebates through their council rates as part of the water conservation scheme the HCC operates. This close relationship with HCC has seen MPAT play a critical role in the development of the WSUD demonstration site. Receiving support from HCC, DEP and the RTBG, MPAT was successful in obtaining funding to help develop the WSUD demonstration site. Furthermore, they have developed a comprehensive training program to build the capacity of plumbers to understand the principles of WSUD and implement its infrastructure to best management practice requirements.

5.2 Evaluation of local partnership promoting WSUD

The results reported here were attained through a synthesis of research activities investigating an institutional partnership in promoting WSUD to the Southern Tasmanian Community. The partnership is still young in its development, however, the members involved have been designing and implementing a number of initiatives to promote sustainable water use within Southern Tasmania. Central to the partnership, to date, has been the construction of a rain garden and the implementation of a WSUD training module for plumbers, both located at the RTBG.

The success of this project will be assessed in this chapter against four criteria. These are summarised to:

(1) promote the growth of the collaborative partnership for WSUD – partnership development with respect to sharing of knowledge, further physical project initiatives, signing of agreements, acceptance of new partners, and further capacity growth within individual partner organisation;

(2) implement structural models promoting WSUD – delivery of demonstration sites displaying environmental technologies or enhancing urban sustainability, and acting as facilitator or advisor to others seeking to establish new and improve existing demonstration sites;

(3) design and implement effective education programs to deliver capacity for achieving WSUD within the urban environment –

design and deliver WSUD training programs for professionals involved in the construction and development industries, landscaping and architecture, and community education programs;

(4) effectively promote existence of education programs and demonstration sites to the community –

develop community awareness of WSUD demonstration sites and opportunities for training through marketing and promotional tools, and monitor and evaluate level of awareness achieved.

The indicators used in the assessment provided below were derived from both empirical primary data and especially responses made by key and targeted informants, and questionnaire responses. Other relevant information gathered from the researcher's field observations and review of secondary literature. In particular, Leach and colleague's (2001) evaluation of watershed management in Washington and California assisted in the criteria selection.

5.3 Results and discussion

5.3.1 Criterion (1). Promote the growth of the collaborative partnership for WSUD

Data to address this criterion was collected through the use of semi-structured interviews with four primary informants, one from each of the agencies involved in the project partnership and members of the steering group.

Results

Despite the infancy of the WSUD project, respondents indicated that all partners involved have already benefited from the project professionally. There was consensus that the partnership as "a healthy union" (MPAT Rep pers. comm. 2006a) has been highly successful. All saw "the partnership to be a positive experience in promoting education and better water management" (HCC Rep pers. comm. 2006a). Evidence of this can be seen, argued one respondent, in a growth of awareness of new technologies and practices.

> Internal ramifications are that all partners have grown professionally, have developed greater awareness of new practices and technologies...The project has been invaluable in raising awareness. It has influenced the water use strategy within the Gardens...The project has provided ideas for new initiatives within the Gardens: Water recycling and rainwater harvesting for toilet flushing project (RTBG Rep pers. comm. 2006a).

It was clear that all project partners have played an integral and active part in the design and implementation of the project. For example, the Derwent Estuary Program acted in an advisory role due to their development of WSUD technical guidelines for Southern Tasmania and their involvement in monitoring stormwater quality entering the River Derwent (DEP Rep pers. comm. 2006a).

In addition to acting in an advisory capacity, all partners contributed human resources to the project. DEP took on the responsibility of water quality testing of stormwater runoff after it had passed through the treatment process of the rain garden, as the water was to eventually enter the Derwent River (DEP Rep pers. comm. 2006a). MPAT took on the primary role of applying for funding of the project from the Envirofund. They

also provided trained personnel to install the *rain garden* plumbing infrastructure (DEP Rep pers. comm. 2006a). RTBG provided the staff to build the 'rain garden' structure and plant suitable flora to aid in the biofiltering process of the garden (RTBG 2006, np).

The Royal Tasmanian Botanical Gardens was considered to be "an ideal site to showcase WSUD principles" (MPAT Rep pers. comm. 2006a) due to both the nature of the physical environment, adjacent to the Derwent foreshore, and the ease and extent of public access to the site, especially the volume of local visitors.

Co-operation on issues of water management between some of the partners was already well developed prior to the WSUD project. This was a result of a shared vision in developing strategies to implement best practice water management across the community. For example, a past director of the RTBG (Steve Corbett) formed a close working relationship with the manager of Hydraulic Services (HCC), through a shared interest in developing new strategies for Water Management, this leading to a Memorandum of Understanding being signed by the RBTG and HCC (HCC Rep pers. comm. 2006a).

MPAT started up Green City Services in 2003 in partnership with HCC. Due to the Tasmanian connection with Princess Mary of Denmark, the executive officer thought a further connection could be made with Denmark in a professional sense. He became aware of the Green City Denmark program. It is a "profound environment program supported by industry, Government and various parties" (MPAT Rep pers. comm. 2006a). The shared vision on sustainable water management held by MPAT and HCC

led to a Memorandum of Understanding being signed by both parties in recognition of MPAT's involvement in the HCC's Water Conservation Rebate Scheme.

A passion for water conservation is an intrinsic motivation for all of the key informants in developing a more sustainable approach to urban water management. In a professional context, the HCC Rep (2006a) regards it to be "good engineering and management of a natural resource". Despite the shared vision, some misunderstanding or misinterpretation has occurred, causing some frustration between the role each partner was required to perform, how he or she performed it, or a lack of understanding on some principles of WSUD.

> The management of the rainwater project was poor at times...some duplication took place on engineering design with HCC council working on it and RTBG hiring a consultant at the same time! (HCC Rep pers. comm. 2006a).

> It's like hitting your head against a brick wall! (DEP Rep pers. comm. 2006b)

It is conceivable that one of the partners could have developed this project alone, however, the fiscal and human resources required would likely have made it impracticable. The collaborative nature of this project has enabled the partners to "pool resources" (MPAT Rep pers. comm. 2006) in sharing technical expertise and educational resources, supporting the Envirofund application process, and providing labour for the installation of the rain garden, with minimum impact on their own reserves.

The partnership "continues to grow" (MPAT Rep pers. comm. 2006b) and has received further funding from Envirofund to build another demonstration site that promotes

rainwater harvesting for toilet flushing. This will be located by the visitor information centre, which receives a high number of visitors, as it also co-joins the RTBG restaurant and gift shop. The Huonville Police Youth citizen club is installing a rainwater tank for toilet flushing at its centre and "we (MPAT) are acting in an advisory role" (MPAT 2006). The growth of the partnership is not restricted to the WSUD demonstration site. It continues to build on what has been learnt from this experience in developing partnerships with the wider community. For instance, reported the RTBG member of the steering committee,

> We are always open to new initiatives ...We are always looking inward to see how water resources are used? How can the consumption be reduced?...Recycling possibilities? (RTBG Rep Feb 1, 2006)

Apart from their involvement in the rainwater/toilet flushing project, they are now looking to setting up a recycling hub within their Horticultural Sustainable Precinct to showcase the role recycling can play in sustainable communities " (RTBG Rep pers. comm. June 9, 2006b).

5.3.2 Criterion (2). implement structural models promoting WSUD

Data to address this criterion was collected through the use of semi-structured interviews with (4) key informants, follow up correspondence and through personal observation made by the researcher.

Results

Installation of the rainwater garden, the central element of the WSUD demonstration site, was completed in November 2005. "The initial project met with deadlines and operates successfully" (RTBG Rep 2006) It is widely recognised by water management

professionals as conforming to best management practice (BMP) to reduce non-point source pollution from urban areas.

This WSUD demonstration site is highly visible and is well supported by interpretive material. It is located within the Horticultural Sustainable Precinct (HSP). "The idea behind the HSP is to showcase other sustainable practices for the environment, such as sustainable organic gardening used in Pete's Vege Patch [as seen in ABC's Gardening Australia]"(RTBG Rep pers. comm. June 9, 2006b). The installation of the rainwater tank/toilet flush system will further extend the partnership's commitment to promoting WSUD and sustainable practices. In addition to this, MPAT's advisory role with the Huonville Police Citizen Youth Club's WSUD project reinforces the value of the WSUD project in promoting WSUD to community.

5.3.3 Criteria (3) design and implement effective education programs to deliver capacity for achieving WSUD within the urban environment.

As part of a capacity building program for their profession, MPAT designed and promoted a WSUD training module, which has been incorporated into their 'Green City Services' training program. The training module was to be delivered in two stages. Theory was the first component and this was to be followed up by a 'hands on' training session installing the WSUD infrastructure within the rain garden.

MPAT has delivered the theory component to (9) plumbers and (6) other interested parties. An in-depth assessment was carried out by this researcher to determine its effectiveness in facilitating the uptake of WSUD practices within the plumbing profession. A particular emphasis was placed in this evaluation on the question of how effective the education module was in developing plumbers' understanding of the

principles of WSUD and whether it increased their capacity to implement WSUD in their everyday work practices. Questionnaires were sent to all plumbers who participated in the WSUD training module (see appendix 6). A different questionnaire was sent to (40) plumbers who had not participated in the training module (see appendix 7). This survey questioned plumbers on what their existing knowledge was of WSUD, what role they believed their profession had in promoting sustainable practices in the community and why they did not participate in the training course.

MPAT indicated that more plumbers would have completed the training module prior to this survey being carried out, but this did not occur. Only (9) had completed this course prior to circulation of the questionnaire. The evaluation of the training module explained the following:

- design of WSUD manual;
- quality of module delivery;
- coordination (timing) for theory component and practical component;
- relevance of material to participants
- capacity building;
- the manual's structure.

Results

The WSUD training module manual prepared and implemented by MPAT is a comprehensive and well-presented package. It is well structured with a logical flow to the organisation of content. The course objectives are set out clearly and early in the manual. The text is descriptive, but is not too complex and is easy to comprehend. Diagrams, tables and other figures are used in an efficient manner and complement the

text when required. They are clearly defined, have good resolution and are explained clearly. The manual provides guidelines by the *WSUD Engineering Procedures for Stormwater Management in Southern Tasmania 2005* for the implementation of WSUD practices.

The delivery of the four-hour course was carried out in the RTBG training centre conference room, with participants seated around one long table. Refreshments were available and an interval was taken half way through the module presentation. The room was well ventilated, but it did have a rather noisy heating system.

The theoretical content was delivered in PowerPoint format with the instructor guiding the participants through the manual. Most of the content in the manual was covered, albeit sometimes a little rushed. The second part of the evening involved small group work, with participants applying a WSUD approach, to an existing example where conventional stormwater infrastructure had been used. A forum discussing the general content of the course was held towards the end of the session. A short evaluation form was provided for participants to complete at the end of the session. The instructor was clear in delivery and confident in their knowledge of the subject material. Questions were welcome throughout the delivery, and answered by her, or referred to another professional with the relevant experience to address the question.

Most questionnaire respondents regarded the delivery of the module to be clear and informative, although one respondent reported that "It was informative, but some aspects were not all that clear to me".

Mixed responses were obtained in regards to the relevance of the course content to the participants' workplace. Three believed it was relevant. One believed it was not. Others were unsure.

Most participants did not participate in the practical component of the training module. The intention was for them to be involved in the installation of the plumbing infrastructure of the rain garden. However, MPAT explained that structural timing made it difficult to get hold of the participants. When contacted at short notice, they were often too busy or had other commitments and could not attend (MPAT Rep pers. comm. 2006b).

This assessment of the capacity building qualities of the course is reliant on responses to certain questions in the questionnaire. The responses were coded to four themes: 'awareness', 'understanding', 'implementation' and 'promotion'. The first three elements represent educational outcomes of the module. After completion of the module, participants should be aware of what WSUD is, understand how it can be used, and install WSUD infrastructure within BMP guidelines when required. Promotion refers to their contribution in creating a wider awareness of WSUD within the community.

Six respondents did have some prior awareness and understanding of WSUD, having heard of it from colleagues and industry literature. Respondents did indicate an understanding of WSUD (post training), and indicated their needs to develop their understanding more.

> Yes, although I may need to have an update course again as you forget certain information after awhile.
>
> Yes, but not enough skill on how to communicate positively with customers.
>
> Yes – water saving devices – but experience and greater innovation will see more flexible application and use of WSUD practices.

Most respondents had not had the opportunity to install WSUD infrastructures within the urban environment. Two respondents believed the facilitation of WSUD for use into the community would be quite difficult.

> Unfortunately, the community is not interested in WSUD because of the perceived capital outlay, especially in Hobart who refuses to subscribe to user pays pricing for water. Customers are not interested in filling out forms for rebates for embracing WSUD. The only way to succeed with WSUD is give the age-old hip pocket incentive.
>
> Difficult. Need to sell concepts, make special application for permits and, in some cases, the cost is greater than the standard practice in the trades.

A mixed response was given in regards to the question of WSUD becoming a core component of the plumbing industry. Three respondents believed it would, while one responded in greater depth.

> No (not foreseeable). There are already more competencies than time permits. It is a specialist area requiring some vision and passion on the part of some plumbers, but not all.

When questioned on the subject of sustainable water practice, all respondents believed that their industry was key player in its promotion in the community.

5.3.4 Criteria (4) effectively promote existence of education programs and demonstration sites to the community

Data to address this criterion was collected from information through the use of semi-structured interviews with the (4) primary informants. The RTBG education officer also

provided information. Five Councils within the greater Hobart area were also contacted. Officers provided information in regards to their levels of awareness of the WSUD demonstration site.

Results

Several strategies are in use to promote the WSUD demonstration site. The RBTG has made good use of their website. A web page documents the function of the rain garden in good detail, inclusive of pictures. Links connecting to DEP, HCC and MPAT are evident. The RBTG has also published a Fact Sheet on the rain garden, which is available at the visitor information centre. The rain garden is part of the Sustainable Horticultural Precinct, which highlights sustainable practices within the garden environment. School groups and other educational institution groups are made aware of this precinct during excursions or adult education courses. Information regarding the WSUD demonstration site has been distributed via Infostream. This is an online clearing house that distributes departmental and non-departmental information to staff and select external organisations by email. A mobile model of a rain garden is displayed at rural shows and most recently at Agfest, which receives approximately 70,000 visitors.

Promotion of the WSUD demonstration site to local councils, and industry is considered to be outside the scope of the RTBG (RTBG Rep pers. comm. 2006b). MPAT has promoted the demonstration site to its members via flyers and during association meetings. MPAT also promotes WSUD through advertisements placed in the Local Councils Association of Tasmania (LGAT) newsletter.

No information has been sent to the development industry, engineering professionals or local governments. Officers representing Hobart regional councils were questioned on their awareness of the WSUD demonstration site. Two out of ten were aware of it.

5.4 Evaluation overview

On evidence provided by the evaluation in this study, it could be argued that the WSUD demonstration project has been successful in achieving desired outcomes as set out by the project partners. The rain garden is in operation and it is an excellent example of a WSUD BMP device. The project partners continue to develop initiatives promoting WSUD to the community, within the RTBG and in other locations. The DEP is not involved in the new projects, but they are currently developing strategies to facilitate the adoption of WSUD by local government authorities.

The promotion strategies used by the RTBG seem to be adequate, but no data is available to gauge its effectiveness. It may be useful for one of the partners to take on some responsibility in promoting the existence of the WSUD demonstration site to local governments and professionals within the development and engineering industries. A training program, not unlike the module offered by MPAT would be useful in increasing the capacity of these professionals to adopt WSUD practice within their field.

The WSUD training module developed by WSUD is informative. Feedback received from questionnaires suggests that the participants' technical understanding of WSUD infrastructure is good. However, some responses indicated a limited understanding of the underlying principles of WSUD. Despite its title, some believed it was for rural

developments only, and not applicable to suburban areas. Some also perceived that the cost of WSUD infrastructure made it an unpopular choice.

Seven out of nine questionnaires sent to WSUD training participants were returned. One non-WSUD module participant questionnaire was returned. Only three people indicated an interest in attending a forum. A higher number of participants in both questionnaires would allow more scope to make absolute findings on the topics covered. Overall, it would be imprudent to make any hard fast judgement on the data received. These and other issues will be discussed further in the thesis research findings in Chapter 6.

Chapter 6

Conclusion

6.1 Chapter Overview

This chapter provides an overview of the content of each chapter. This is followed by a discussion of the significant findings of this research and recommendations for further research.

Chapter 1 provided the background to this research into institutional and social capacity building for WSUD, by highlighting the urgent need for substantial changes in water management in Australia, especially within cities. The qualitative research methodology used in this study was also outlined.

Chapter 2 offered a discussion of two key strategies; partnerships and education, which are widely regarded as integral to the practical uptake of sustainable practices within the community. Partnerships allow stakeholders to work together in defining, designing, implementing and monitoring policy for sustainability. The nature of partnerships allows people to build the social capital required for a shared solidarity of purpose, to share their knowledge and resources, and plan and implement strategies to address a particular problem. Education is the key instrument in engaging people in the task of adopting more sustainable lifestyles. It can be used to develop awareness and interest, providing a catalyst for them to take action to achieve more positive everyday habits.

Chapter 3 highlighted WSUD as a vital component of integrated water management strategies. WSUD was seen to be an inter-related set of planning, design, and engineering approaches with a two-fold purpose: to retain stormwater as a resource and to reduce pollutant loads into ecosystems.

The implementation of WSUD within the community is highly dependent on its adoption by local government, the urban development industry and the allied construction industry. Using examples of current strategies for promoting WSUD around Australia, Chapter 4 outlined key barriers to the uptake of WSUD throughout Australia, including planning and policy obstructions, economic issues, and a lack of expertise in relevant professions.

Central to this research was the study of a project partnership promoting WSUD to the Southern Tasmanian Community. Chapter 5 observed the origins of this project partnership, detailed the strategies that have been employed to promote WSUD, and evaluated of the effectiveness of this project.

6.2 Research findings

The main aim of this study was to assess the effectiveness of institutional strategies currently being used to facilitate sustainable management of urban water systems in Australia. This aim was, in large part, realised through primary study of a local, Southern Tasmanian partnership actively promoting the use of an innovative strategy to achieve sustainable urban water management.

The evaluation presented in Chapter 5 indicated a significant lack of interest in WSUD within the Tasmanian plumbing profession, despite the laudable efforts of the Master Plumbers Association of Tasmania. Information received from plumbers as well as key and targeted informants, observations made by the researcher, a comparative study of several national WSUD initiatives and a review of relevant academic literature led to the following significant findings:

- there is limited capacity for implementing WSUD in the Tasmanian plumbing industry;
- there is a need for WSUD capacity building programs for Southern Tasmanian institutions (local government, developers, designers, and industry);
- there are inadequate institutional incentives in place for development industry to adopt WSUD as the default stormwater management practice;
- adoption of WSUD in Southern Tasmania lags significantly behind the recognition of the need for it, despite institutional rhetoric suggesting otherwise;
- the Derwent Estuary Program is an example of national best practice in WSUD facilitation;
- WSUD demonstration sites are important in increasing uptake of this practice;
- collaborative institutional partnerships enable an increased knowledge transfer, pooling of resources and integrative perspective that does increase capacity for uptake of new, sustainable forms of environmental management.

6.3 Discussion

One of the specific research questions for this study was: what strategies are successful in facilitating WSUD practices within the plumbing industry? The main strategy engaged by one of the project partners, MPAT, was to design and implement a training package to build the capacity of plumbers to adopt WSUD procedures within their workplace. Two different questionnaires were sent to prospective participants. Apart from addressing the issues directly related to the WSUD training module, other

questions invited them to express their opinions on sustainable practices within their industry and the relationships that they had with local government and clients. From data collected, it was anticipated that a picture could be drawn that would explain their feelings about water conservation, their role in promoting the sustainable use of water, and the support and guidance they may receive from local government and other institutions. Responses made by WSUD training module participants indicated that plumbers are genuinely interested in providing a service that involves an effective management of stormwater, but their understanding of how WSUD can be implemented is still limited – they believe the practice is primarily to do with rainwater harvesting (water tanks), rather than a total integrated approach that treats stormwater as a resource, but also reduces the impact of what it carries (pollutants) to receiving ecological systems.

Seven of the nine questionnaires (77%) sent to WSUD module participants were returned. These figures in themselves represent a significant finding. It could be argued that the WSUD module participants seemed highly motivated to learn and further develop their knowledge and skills to adopt sustainable practices within their everyday work. They are also pro-active in assisting in the design and development of future training programs to increase their profession's capacity to adopt sustainable practices. The letters sent to both groups of participants were printed on a MPAT letterhead and gave a clear explanation of how their participation could benefit their professional growth and their association. The questionnaire directed at non-participants in the WSUD module was sent to forty plumbers. None were returned. The survey was then re-sent again, and only one was returned. The limited response from non-WSUD module participants may indicate that WSUD is not in the sphere of their professional

concern at this point in time. In consultation with MPAT on this matter, a key informant speculated that poor participation in the WSUD training module in the first place and then in the evaluation questionnaire was typical of the construction industry during the boom years experienced in Tasmania over the last five years. Due to the influx of work tradesmen currently have, the development of new skills and, awareness of new practices is considered as a "need to know" basis. Putting time aside to become involved in environmental training and research is a low priority for many.

As indicated in Chapter 4, councils within the greater Hobart area demonstrate inconsistent provision of WSUD within their planning systems and stormwater policies. One of the major barriers identified in this research was the lack of opportunity and time council officers have to develop their knowledge of WSUD and to implement policy reviews to accommodate it. As highlighted in Chapter 4, a centralised capacity building program would provide Hobart councils with the opportunity to address these needs and other requirements to see WSUD become the default stormwater management strategy.

The lack of strong regulation and policy guidance for WSUD in Hobart councils do not encourage developers to utilise this practice. Some developers are prepared to implement this practice, but councils will often implement demands that restrict the effectiveness of the WSUD design (see Chapter 4).

The DEP continues to play a key role in promoting sustainable water management strategies. Their publication *A model stormwater management plan for Hobart Regional Councils – a focus on the New Town Rivulet Catchment 2004* clearly outlined issues with conventional stormwater management and highlighted alternative approaches to

reduce the impact of stormwater on the Derwent River Estuary. In 2005, DEP released technical guidelines on WSUD for use by developers, designers, plumbers, and local governments. DEP is currently developing a capacity building program for professionals involved in the professions listed above and local governments to facilitate the wholesale adoption of WSUD by these institutions.

Literature reviewed, with a particular reference to the Lynbrook Estate, indicated the usefulness that such sites have in showcasing the principles and benefits of WSUD (see Chapter 4). Demonstration sites are an invaluable learning tool; they serve to increase awareness, and allow a more comprehensive understanding to develop amongst interested stakeholders. The availability of such sites would serve to enhance the effectiveness of a capacity building program.

Finally, the WSUD demonstration training site at the RTBG was created by the collaborative efforts of four partners. The project has been a success to date, and continues to grow in its accomplishments. Due to the restrictive nature of their resources, both human and financial, it is unlikely that any of the partners would have developed a demonstration site such as the rain garden. In sharing resources, knowledge and skills, this vision has been achieved.

6.4 Further research recommendations

This research should be regarded as a pilot study for future research into institutional and social capacity for WSUD and other sustainable urban environmental management initiatives such as the topics discussed. More detailed research is required to ascertain the true capacity for WSUD in the greater Hobart councils. Data collected from such a

study will be used for in planning an appropriate capacity building program to address their needs. Furthermore, a similar study involving local developers would be of value in order to determine their understanding of WSUD and barriers which restrict them from using it.

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Appendix 1

School of Geography and Environmental Studies

Partnerships promoting WSUD

Dear _ _ _ _ _ _ _ _

my name is Anthony Hyland and I am currently undertaking a thesis on WSUD as part of a Masters in Environmental Management.

As part of my study I wish to evaluate the *strategic partnership* formed between your agency and the Royal Tasmanian Botanical Gardens(RTBG), the Master Plumbers Association of Tasmania(MPAT) and the Derwent Estuary Program(DEP). I would like to interview you in regards to the operation of this partnership and your agency's involvement. This interview should take about 30-minutes at a time and venue of your choosing in November.

Information provided by you will enable me to evaluate the effectiveness of the partnership in an objective manner. To this end, I will be making recommendations that may improve the efficiency and success of the partnership in achieving its desired outcomes.

Thank you for considering this request.

Yours sincerely,

Anthony Hyland (BEd)

Statement of Informed Consent

Title of Project: *Developing strategies that will promote Water Sensitive Urban Design within the Tasmanian community*

1. I have read and understood the 'Information' Sheet for this study.

2. The nature and possible effects of this study have been explained to me.

3. I understand that this meeting will involve a interview of approximately 30 minutes and it will be taped on a digital recorder.

4. I understand that all research data gathered from me for the study will be securely stored on the University of Tasmania premises for at least five years, and will be destroyed when no longer required.

5. Any questions that I have asked have been answered to my satisfaction.

6. I agree that the research data gathered from me for the study may be published provided that I cannot be identified as a participant.

7. I understand that my identity will be kept confidential. Any information I supply to the researcher will be used for the purpose of this research project only.

8. I agree to participate in this investigation and understand that I may withdraw at any time without any adverse effect, and can request that any information I have provided to this point will be erased or returned to me.

Name of Participant:

Signature: Date:

****

This section to be filled in by Investigator

Statement by Investigator

I have explained this project and the implications of participation in it to this volunteer and I believe that the consent is informed and that he/she understands the implications of the participation.

Name of Investigator: Anthony Hyland

Signature of Investigator: _____ Date: _____

Appendix 2

WSUD Education Module Evaluation

Information Sheet

Date:

Title of Investigation
An investigation and evaluation of a strategic partnership promoting sustainable use of water within the Tasmanian community.

Name of Principal Investigator
Anthony Hyland (Bed) - principal researcher and author of this research.

Study Background
Fresh water supply in several Australian cities is now reaching a crisis point. Two factors that have contributed to this situation are a severe reduction in rainfall over extended periods, and an increase in population, this leading to an increase in water consumption within these centres. Due to climatic change and the changing demographics of our cities this crisis cannot be averted without a paradigm shift in our habits as consumers of water.

Water Sensitive Urban Design (WSUD) is one concept that can help reduce water consumption within urban centres. Developing awareness in the broader community about the benefits of WSUD will depend on strategic partnerships being developed between government agencies and industry associations.

The main purpose of this study is to evaluate existing strategies and, if appropriate, to make recommendations to improve and advance the implementation of WSUD within the urban planning framework in Tasmania.

Purpose of Interview
The purpose of this interview is to attain information on the objectives and strategies of the current partnership formed by RBTG, HCC, DEP, and MPAT.

Benefits to Participants
On the basis of information gathered, an evaluation will be carried out on the effectiveness of the current WSUD. Recommendations will be made to the partners aimed at assisting in the management and implementation of future programs promoting WSUD.

Why have you been chosen?
As a central figure in your respective agency, you are recognised as a key informant that may provide relevant and useful information for this study.

Digital recording
It is my intention to use a digital tape recorder during the interview to assist in note taking. A transcript of the recording will be available to you on request if you wish to edit or add any information.

Anonymity
Your anonymity will be maintained by the ommission of any information that may directly identify you, although your employer institution will be identified.

Confidentiality
The hardcopies of these questionnaires will be kept in a secure location at the University of Tasmania for a period of no less than five years after the publication date of the study.

Voluntariness
Your participation in this research is strictly of a voluntary nature. You may withdraw from this study anytime that you may wish and you may also withdraw any information you have provided.

Contact Persons for research
The main contact in regards to this research is Anthony Hyland
Phone 62448600 Mobile 0438214233
E-mail ant@southcom.com.au

Statement approval from ethics committee (Pending)

If you have any Concern
If you have any concerns of an ethical nature or complaints about the manner in which the project is conducted, please contact the Executive Officer of the Human Research Ethics Committee (Tasmania) Network.

Executive Officer: Amanda McAully
Phone 62262763

Results of Investigation
Recommendations made as a result of this study will be made available to MPAT, RTBG, DEP and HCC to assist in the assessment and management of their program.

Documents
You have been provided with a an information sheet for you to read prior to this interview and two copies of the consent form, one for you you to retain.

****

Aidan Davison
Chief Investigator

Anthony Hyland
Researcher

Appendix 3

Interview Schedule

Listed below are

- What was the catalyst behind the formation of this partnership?
- What are the objectives of the partnership?
- What are the strategies being used by this partnership to promote sustainable use of water within the Tasmanian community?
- What is the central link between each of the partners?
- What is the role of each partner and what independent strategies are they employing to attain their desired outcomes? How are these strategies evaluated?
- Is the partnership working? Is behaviour changing in the community in regards to water use? Are any statistics available that may indicate a paradigm shift in water consumers' behaviour?
- Can the partnership be developed further to improve outcomes?

Appendix 4

UTAS

School of Geography and Environmental Studies

Master Plumbers' Association ofTasmania
2 Clutha Place, South Hobart, Tas. 7004.
Telephone: (03) 6224 0170
Facsimile: (03) 6624 0189
Email: infopack@netspace.net.au

Have your say on Water Sensitive Urban Design!

Dear Sir/Madam,

my name is Anthony Hyland and I am currently undertaking a Masters in Environmental Management.

What is this about?

As part of my studies I am evaluating the Water Sensitive Urban Design (WSUD) education module carried out by the Master Plumbers Association of Tasmania (MPAT). To this end I am asking all those who attended this module, including you, to assist by completing a short *questionnaire*. You are also invited to take part in subsequent 1-hour discussion group. To accept this invitation simply write your name and contact details on the sheet provided and post it in the separate envelope provided. Please do not post it in the same envelope as your questionnaire.

Will your help make a difference?

Yes! Information provided by you is *crucial* to the success of this evaluation. The questionnaire directly relates to your occupation as a plumber and any knowledge you have of WSUD practices. Information you contribute will enable me to make sound recommendations to MPAT to improve the content and implementation of the course. This will lead to a more refined education package that will provide plumbers with a higher degree of expertise in WSUD.

How can you help?

Questionnaire With this letter you have received an information sheet about my research project, a copy of the questionnaire, a discussion group response sheet and two stamped, self-addressed envelopes. Please: 1) read the information sheet and, if you are happy to do so, 2) fill out the questionnaire and 3) put it in the envelope provided. Please return by

Friday, November ___. It is anticipated that the questionnaire will take approximately *fifteen minutes* to complete.

Discussion Group Those willing to assist further are invited to come along to informal discussion of approximately *one hour* with a small group of fellow plumbers. This is an opportunity to share ideas and experiences (and a beer) with fellow plumbers about WSUD and enable me to attain a greater insight into your thoughts and feelings on the concept of WSUD. It will be held one evening at the Education Centre at the Botanical Gardens at a date yet to be determined. A light supper and drinks will be provided.

Thank you for considering this request.

Yours sincerely,

Anthony Hyland (BEd)

WSUD Education Module Evaluation

Information Sheet

Date:

Title of Investigation
Evaluation of the Water Sensitive Urban Design Education Module

Name of Principal Investigator
Anthony Hyland (Bed) - principal researcher and author of this research.

Study Background
Fresh water supply in several Australian cities is now reaching a crisis point. Two factors that have contributed to this situation are a severe reduction in rainfall over extended periods, and an increase in population, this leading to an increase in water consumption within these centres. Due to climatic change and the changing demographics of our cities this crisis cannot be averted without a paradigm shift in our habits as consumers of water.

Water Sensitive Urban Design (WSUD) is one concept that can help reduce water consumption within urban centres. Developing awareness in the broader community about the benefits of WSUD will depend on strategic partnerships being developed between government agencies and industry associations.

The plumbing fraternity is one of these agents that will play an integral part in this concept development and will be the principal technicians dealing with much of the technology associated with WSUD.

Purpose of questionnaire/discussion groups
The purpose of this study is to evaluate the effectiveness of the Education and Training Modules that were developed and implemented by the Masters Plumbers Association of Tasmania (MPAT) to promote the concept of Water Sensitive Urban Design to plumbers.

Benefits to Participants
From information gathered, an evaluation will be carried out on the effectiveness of the current WSUD education course being run by MPAT and the demonstration site situated at the Royal Tasmanian Botanical Gardens (RTBG). From results attained and further research, recommendations will be made to MPAT that will improve the content and implementation of the course that would make it beneficial to plumbers wishing to integrate the concept of WSUD within their field of expertise and to also pass onto future clients.

Why have you been chosen?
As a member of the Masters Plumbers Association of Tasmania you have been chosen as a possible participant in this study. This information sheet, letter and questionnaire have been mailed to you by MPAT. Your personal details are currently unknown to me.

Questionnaire instructions
Please attempt each question if possible. This questionnaire has been designed to be answered in short response. If your written response is longer than the space provided please feel free to write it on a separate piece of paper and submit it with the questionnaire.

Discussion Group Invitation
Please be sure provide your name and contact details on the sheet provided if you are prepared to be involved in further study as mentioned in the introductory letter. Please post it in the envelope provided, not with your questionnaire.

Anonymity
The nature of this study will not deem it necessary to use participants' names. If you respond to the discussion group invitation, your name and contact details will be used for the purpose of organising the discussion group and will not be used within the study itself.

Confidentiality
The hardcopies of these questionnaires will be kept in a secure location at the University of Tasmania for a period of no less than five years after the publication date of the study.

Voluntariness
Your participation in this research is strictly of a voluntary nature. You may withdraw from this study anytime that you may wish and you may also withdraw any information you have provided.

Contact Persons for research
The main contact in regards to this research is Anthony Hyland
Phone 62448600 Mobile 0438214233
E-mail ant@southcom.com.au

Statement approval from ethics committee (Pending)

If you have any Concern
If you have any concerns of an ethical nature or complaints about the manner in which the project is conducted, please contact the Executive Officer of the Human Research Ethics Committee (Tasmania) Network.

Executive Officer: Amanda McAully
Phone 62262763

Results of Investigation
The results of this study will be passed onto the Master Plumbers Association of Tasmania and you are invited to access a copy of this through them.

****

Aidan Davison
Chief Investigator

Anthony Hyland
Researcher

Appendix 5

UTAS

hool of Geography and Environmental Studies

Master Plumbers' Association of Tasmania
2 Clutha Place, South Hobart, Tas. 7004.
Telephone: (03) 6224 0170
Facsimile: (03) 6624 0189
Email: infopack@netspace.net.au

Have your say on Water Sensitive Urban Design!

Dear Sir/Madam,

My name is Anthony Hyland and I am currently undertaking a Masters in Environmental Management under the management of Dr Aidan Davison at the University of Tasmania.

What is this all about?

As part of my studies I am investigating the importance of Water Sensitive Urban Design (WSUD) within the plumbing industry. The Master Plumbers Association of Tasmania (MPAT) is currently operating an education module on WSUD and I am involved in its evaluation. I am asking you to assist me in this task by completing a short *questionnaire*. You are also invited to take part in a subsequent 1-hour discussion group in WSUD. To accept this invitation simply write your name and contact details on the sheet provided and post it in the separate envelope provided. Please do not post it in the same envelope as your questionnaire.

Will your help make a difference?

Yes! Information provided by you is *crucial* to the success of this evaluation. The questionnaire directly relates to your occupation as a plumber and any knowledge you may have of WSUD practices. Your involvement will enable me to evaluate the relevance of the WSUD module being run by MPAT to your professional development needs.

Information contributed by you will enable me to make sound recommendations to MPAT to improve the content and effectiveness of the course. This will lead to a more refined education package that will provide plumbers with a higher degree of expertise in WSUD.

How can you help?

Questionnaire With this letter you have received an information sheet about my research project, 2 copies of the Statement of Informed Consent form (one for your records), a copy of the questionnaire and a stamped, self-addressed envelope. Please: 1) read the information sheet and, if you are happy to do so, 2) sign one of the consent forms, 3) fill out the questionnaire and 4) put them in the envelope provided. Please return by *Friday,*

November ___. It is anticipated that the questionnaire will take approximately *fifteen minutes* to complete.

Discussion Group Those willing to assist further are invited to come along to informal discussion of approximately *one hour* with a small group of fellow plumbers. This is an opportunity to share ideas and experiences (and a beer) with fellow plumbers about WSUD and enable me to attain a greater insight into your thoughts and feelings on the concept of WSUD. It will be held one evening at the Education Centre at the Botanical Gardens at a date yet to be determined. A light supper and drinks will be provided. A separate information sheet for the discussion group will be supplied to those interested in attending it.

Thank you for considering this request.
Yours sincerely,

Anthony Hyland (BEd)

WSUD Education Module Evaluation

Information Sheet

Date:

Title of Investigation
Evaluation of the Water Sensitive Urban Design Education Module

Name of Investigators
Dr Aidan Davison (Chief Investigator and Supervisor)
Anthony Hyland (BEd) (principal researcher and author of this research).

Study Background
Fresh water supply in several Australian cities is now reaching a crisis point. Two factors that have contributed to this situation are a severe reduction in rainfall over extended periods, and an increase in population, this leading to an increase in water consumption within these centres. Due to climatic change and the changing demographics of our cities this crisis cannot be averted without a paradigm shift in our habits as consumers of water.

Water Sensitive Urban Design (WSUD) is one concept that can help reduce water consumption within urban centres. Developing awareness in the broader community about the benefits of WSUD will depend on strategic partnerships being developed between government agencies and industry associations.

The plumbing fraternity is one of these agents that will play an integral part in this concept development and will be the principal technicians dealing with much of the technology associated with WSUD.

Purpose of this study
The purpose of this study is to evaluate the effectiveness of the Education and Training Modules that were developed and implemented by the Masters Plumbers Association of Tasmania (MPAT) to promote the concept of Water Sensitive Urban Design to plumbers.

As a member of the Masters Plumbers Association of Tasmania you have been chosen as a possible participant in this study. This information sheet, letter and questionnaire have been mailed to you by MPAT. Your personal details are currently unknown to me.

From information gathered, an evaluation will be carried out on the effectiveness of the current WSUD education course being run by MPAT and the demonstration site situated at the Royal Tasmanian Botanical Gardens (RTBG). From results attained and further research, recommendations will be made to MPAT that will improve the content and implementation of the course that would make it beneficial to plumbers wishing to integrate the concept of WSUD within their field of expertise and to also pass onto future clients

What does participation in this study involve?
Your participation in this study involves completing and returning the enclosed questionnaire.
This questionnaire has been designed to be answered in short response. If your written response is longer than the space provided please feel free to write it on a separate piece of paper and submit it with the questionnaire.

If you are interested in participating in the discussion group stage, please be sure provide your name and contact details on the sheet provided if you are prepared to be involved in further study as mentioned in the introductory letter. Please post it in the envelope provided, { I have an issue with this. I wish to ensure that the participants do not mistakingly post their contact details with the questionnaire, as I wish to maintain their anominity. So I feel I do need to indicate this}with your questionnaire.

Anonymity and Confidentiality
The questionnaire does not require any personal identifying information. It follows that the data collected from the questionnaire is anonymous. If you respond to the discussion group invitation, your name and contact details will be used for the purpose of organising the discussion group and will not be used within the study itself. Again, you will not be identifiable in any of the research output.

The hardcopies of these questionnaires and the audio-tapes and transcripts from the group discussion will be kept in a secure location at the University of Tasmania for a period of no less than five years after the publication date of the study, and will be destroyed when no longer required.

Voluntariness
Your participation in this research is entirely voluntary. In the case of the questionnaire, returning the completed questionnaire evidences your consent to participation. Your consent to participating in the group discussion will be evidenced by signing a consent form, which you will receive with a separate group information sheet upon expressing your interest in participating in the group discussion stage. **Contact Persons for research**
The main contact in regards to this research is Anthony Hyland
Phone 62448600 Mobile 0438214233
E-mail **ant@southcom.com.au**
The contact details for my supervisor, Dr Aidan Davison, are:
Phone 62267590
Email Aidan.Davison@utas.edu.au

Ethics approval and contacts
This study has received ethical approval from the Human Research Ethics Committee (Tasmania) Network.

Results of Investigation
The results of this study will be passed onto the Master Plumbers Association of Tasmania and you are invited to access a copy of this through the MPAT.

****

Aidan Davison
Chief Investigator

Anthony Hyland
Researcher

Appendix 6

UTAS

hool of Geography and Environmental Studies

Master Plumbers' Association of Tasmani
2 Clutha Place, South Hobart, Tas. 7004
Telephone: (03) 6224 017
Facsimile: (03) 6624 018
Email: infopack@netspace.net.a

QUESTIONNAIRE

Evaluating the Water Sensitive Urban Design Education (WSUD) Module

Please provide as much information as possible for each question

1. **How would you rate your understanding of WSUD prior to your participation in this MPAT module? Please tick the appropriate box below:**

   - **I had no understanding of WSUD.** ☐
   - **I had heard of the concept of WSUD.** ☐
   - **I had some knowledge of the principles of WSUD.** ☐
   - **I had some knowledge of the practices and devices involved.** ☐
   - **I had been involved in the installation of WSUD devices.** ☐

2. **If you did have previous knowledge of WSUD practices, did you attain it from other colleagues or from other sources? Please elaborate.**

3. **Did you find the delivery of the module content to be clear and informative?**

4. **Have you found most of the content in the module relevant to your workplace?**

5. **Have you been able to put into practice any of the knowledge you attained from the module? If so, in what manner?**

6. **How difficult do you believe it is to incorporate WSUD into your current work practices and why?**

7. **Have you had the opportunity to inform clients and colleagues of WSUD practices and its benefits?**

8. **Do you feel that this course has prepared you with enough knowledge to install water saving devices in accordance to WSUD practices?**

9. **Would you like to receive on-ground training as part of further WSUD training offered by MPAT?**

10. **Please list any suggestions that could improve the WSUD module. You may like to address the following points:**
    - **Relevance to plumbing industry**
    - **Course content**
    - **Course delivery**

11. **Do you believe that WSUD will become a core component of the plumbing industry in the future?**

12. Do you see your industry as a key player in promoting sustainable water practices within the community?

****

DISCUSSION GROUP

I would like to invite you to participate in further study that will involve a one-hour discussion with a small group of other plumbers. If you feel that you could assist, could you tick the box below.

☐ **I am prepared to participate in a discussion group.**

If you have ticked the box could you please write your name and contact details below.

Name: **Phone:**
E-mail **Mobile:**

Appendix 7

UTAS

ıool of Geography and Environmental Studies

Master Plumbers' Association of Tasmania
2 Clutha Place, South Hobart, Tas. 7004.
Telephone: (03) 6224 0170
Facsimile: (03) 6624 0189
Email: infopack@netspace.net.au

QUESTIONNAIRE

Evaluating Prior knowledge of Water Sensitive Urban Design (WSUD)

Please write as much information as possible for each question

1. **How would do you describe Water Sensitive Urban Design (WSUD)?**

2. **Have you had any training in WSUD or areas related to it? If so, can you give a brief description of the type of training you received and where from?**

3. **Do you think WSUD has an important part to play in your industry? If so, how?**

4. **Have you been involved in the installation of any WSUD devices? If so, what kind of devices? Was it a major development or domestic?**

5. Do you feel that these installations have been successful in achieving their desired outcome?

7. Have local councils or other bodies provided you or your clients with any information or guidelines in regards to WSUD? If so, in what form and was it relevant?

7. Do you believe that WSUD will become a core component of the plumbing industry in the future?

8. Do you see your industry as a key player in promoting sustainable water practices within the community?

9. Would you like to attain more information/training in WSUD?

10. Realistically, how much time would you be prepared to put into further training in WSUD?

11. Were you aware of the MPAT WSUD education module? If so, what constraints prevented you from participating?

****

DISCUSSION GROUP

I would like to invite you to participate in further study that may involve a one-hour discussion with a small group of other plumbers. If you feel that you could assist, could you tick the box below.

☐ **I am prepared to participate in a discussion group.**

If you have ticked the boxes could you please write your name and contact details below.

Name:

Phone :
Mobile :
E-mail: